# The JOURNAL of the NATIONAL DENTAL ASSOCIATION

VOLUME V NUMBER FOUR

$2.00 A YEAR ENTS A COPY

STUDY · PUBLI.


Dr. B. H. Bigelow, Rockford, Ill.

## APRIL, 1918


The Teaching of the Technic of Cleaning, Curetting and Filling Root Canals.—*Coolidge.*

The Chemistry of Silicates and Their Application in Dentistry.—*Vogt.*

After-pain and Its Relation to General and Local Anesthesia Following Operations on the Mouth.—*Hertzler.*

The Carrel-Dakin Treatment of Wounds.—*Loewy.*

An Effort to Fix a Standard of Crown and Bridge Work on Scientific Principles Consistent With Proper Requirements.—*Knoche.*

The Effect of High Pressures on Bacteria.—*Larson, Hartzell, Diehl.*

Dr. John R. Callahan.—*Editorial.*

Dentistry Exempt in Order Commandeering Platinum.—*Editorial.*

# CONTENTS


Page

John Ross Callahan, D. D. S. ..... Frontispiece

ORIGINAL COMMUNICATIONS.

The Teaching of the Technic of Cleaning, Curetting and Filling Root Canals.
By Edgar D. Coolidge, D. D. S. ..... 335
The Chemistry of Silicates and Their Application in Dentistry.
By C. C. Vogt, A. B., A. M., Ph. D. ..... 354
After-pain and Its Relation to General and Local Anesthesia following Operations on the Mouth.
By Arthur E. Hertzler, A. M., M. D., Ph. D., F. A. C. S. ..... 374
The Carrel-Dakin Treatment of Wounds.
By George Loewy, M. D. ..... 387
An Effort to Fix a Standard of Crown and Bridge Work on Scientific Principles consistent with Proper Requirements.
By Karl G. Knoche, D. D. S. ..... 392

THE RESEARCH DEPARTMENT.

The Effect of High Pressures on Bacteria.
By W. P. Larson, T. B. Hartzell and Harold S. Diehl ..... 396

THE EDITORIAL DEPARTMENT.

Dr. John R. Callahan ..... 403
"Sell Your Children or Let Them Die" ..... 405
Personnel of the Dental Corps ..... 406
Dentistry Exempt in Order Commandeering Platinum ..... 406

ARMY AND NAVY.

The Practice of Dentistry in the Army and in Civil Life.
By Lieut. K. F. Smith, D. R. C. ..... 407
The Cleveland Dental Society ..... 408
Naval Dental Corps ..... 409
Information Regarding Sick Soldiers ..... 411
Vacancies in Army Medical Corps ..... 411
Organization of the Office of the Surgeon General, U. S. Army ..... 412
Medical Corps Commissions ..... 414
Medical Department Training ..... 415
Wake Up, America ..... 415
Medical Students Commissioned ..... 416
Medical Corps Personnel ..... 417
Surgeon General Braisted Reappointed ..... 417
Bill for Navy Nurse Corps ..... 418
Dental Corps Orders from War Department ..... 419
Fixing Grades in Medical Corps ..... 420

UNIVERSAL MILITARY TRAINING.

War Need of Universal Training ..... 421
The Crimes of Germany ..... 422
Making Efficient Americans ..... 422
A Pacifist's Argument ..... 423

PREPAREDNESS LEAGUE.

Value of Educational Work of the League.
By H. A. Pullen ..... 424
The Missouri Plan ..... 427
Dental Motor Car Information ..... 428

ITEMS OF INTEREST.

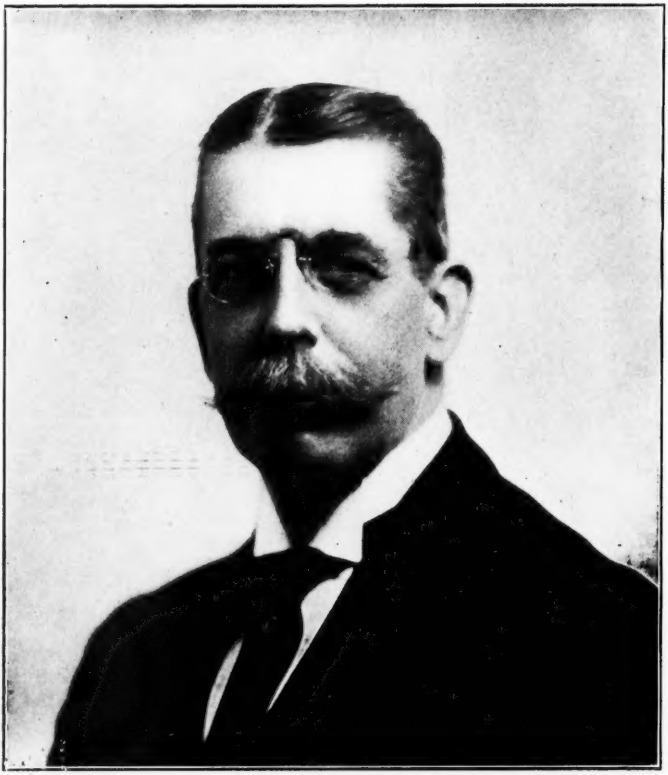
Camp Pike Dental Society ..... 429
Local Society Organized at Camp Shelby ..... 429
Technic of Removing Impacted Molars ..... 430
Interpretation of the Wassermann Test ..... 430
Personal Hygiene Would Save Money ..... 431
Appropriate $1,000 for Dental Materials ..... 431
Dental Caries ..... 432
Country Boys Not Physically Superior ..... 433
Prevention Instead of Cure ..... 433

DEATHS.

John R. Callahan, Dr. Edgar V. Burt, Dr. Isaac H. Davis ..... 434-437

ANNOUNCEMENTS.

National and State Societies Meetings.—Northwestern Alumni Home-Coming Clinic.—North Carolina Dental Society.—Iowa State Dental Society.—Kentucky State Meeting.—North Carolina State Board of Dental Examiners.—Northern Ohio Dental Association.—The New York State Dental Society.—California State Meeting.—Massachusetts Dental Society.—New Mexico Board of Dental Examiners.—North Dakota State Dental Association.—State Board of Dental Examiners.—South Dakota State Dental Society.—Maine Dental Society.—West Virginia State Board of Dental Examiners.—South Carolina State Meeting.—Massachusetts State Meeting.—Indiana State Board of Dental Examiners.—Four States Post Graduate Dental Meeting.—The Annual Meeting of the Illinois State Dental Society at Bloomington, Illinois.—Maine Board of Dental Examiners.—Four States Post Graduate Dental Meeting.—Michigan Board of Examiners.—South Carolina State Board.—Arkansas State Meeting.—South Dakota State Board of Dental Examiners.—Notice ..... 438-445



JOHN ROSS CALLAHAN, D.D.S.

THE JOURNAL
OF THE
National Dental Association
VOL. 5 APRIL, 1918 NO. 4

# Original Communications.

## THE TEACHING OF THE TECHNIC OF CLEANING, CURETTING AND FILLING ROOT CANALS.

By Edgar D. Coolidge, D.D.S., Chicago.

(Read before the Twenty-fifth Annual Meeting of the American Institute of Dental Teachers, at Pittsburgh, Penn., January 29-31, 1918.)

THE executive committee asked me to write on the subject of the Teaching of Root Canal Technic in the Dental College.

In reviewing the proceedings of the Institute, I find no other paper on this subject, altho I find one on the Technic of the Treatment of Pulp Cavities by Dr. Leuman Waugh, read at the meeting in 1910. However, I have assumed from the subject given me that it was desired that the paper should treat of the preparation of root canals for filling and the technic of filling them, which I have attempted to do.

In considering this subject one must ever keep in mind the importance of the service rendered and its vital relation to the general health of the individual. One may not be able or willing to agree that the teaching of this subject requires so much equipment or such exacting technic as will be outlined in this paper until one is thoroly convinced that infection, absorption areas, denuded root ends or even areas of lowered resistance due to injured or irritated tissue where a state of chronic inflammation exists, are all injurious to general health and may be the source of bacterial development from which other organs and tissues of the body become infected by metastasis producing a score of diseases and pathologic conditions any one of which may seriously handicap, if not entirely incapacitate the individual. However, when we take into consideration that from fifty to eighty per cent of the root canals filled in the past are not only imperfect, but abscessed, can we

fail to recognize the need for more careful and more thoro operations in root canal treatment?

Some very startling statements have appeared in the recent literature in regard to the prevalence of chronic infections around root ends of teeth having imperfect root canal fillings. It is stated,[1] that as many as 89% of arthritis patients in one clinic showed periapical infections and chronic abscesses and 74% of patients with other systemic disorders carried the same mouth condition. Another writer states[2] that of root canal fillings which might be classed as good from the radiograph, only 8% were abscessed, while 65% of those classed as poor from the radiograph were abscessed. One very significant fact of this statement is that a very large proportion of poorly filled canals result in chronic abscess, and more large canals enter into the figures than small ones. It is more often the unfilled portion of a large canal that results in periapical infection and chronic abscess than the unfilled portion of the small canal; however, this does not remove the responsibility of leaving small canals unfilled by any means.

The possibility of filling a large or a small canal perfectly even after thoro cleaning to the foramen is uncertain, and unless it is radiographed there is no way of determining the result. This part of the dental service is of the greatest importance since it is so closely related to the general health of the patient. Can we afford to be satisfied with anything less than the best that can be taught or to accept anything less than the very best that can be done in these operations?

Let us consider for a moment some of the reasons why the results of these operations are so unsatisfactory and so often cause great discomfort, suffering and inefficiency of individuals so afflicted. Let us assume that every operator is careful and conscientious and makes a faithful attempt to do his day's work well. There are scores of temptations presenting while the work is in progress, and sooner or later many a determined beginning is warped before the operation is complete owing to some difficulty, common, not only to student operators, but to one of experience, such as the difficulty to place a rubber dam on a short or broken root; an accident tearing the rubber; breaking a broach; losing or plugging up the canal before getting it open; an impatient, restless patient desiring a quick result; loss of interest by operator due to slow progress with the case, or perhaps a feeling of inadequate recompense for the amount of time and energy consumed. We may take great precaution in demanding a complete operating equipment and thoro sterilization of every instrument and all material used, but have a failure in the end unless there is some means of overcoming the subjective difficulties encountered along the way and some means of inspiring interest and enthusiasm sufficient to carry the operator on until he attains the result he started out to reach.

There is no other operation in dentistry that requires more patience and persistence than the cleaning and filling of root canals and what reward is there for a careful and painstaking effort other than the feeling of satisfaction of work well done? Had the effort been spent on making a crown, an inlay or a filling, the result would be a visible object, a smooth, polished, shapely creation of his own, perhaps a work of art to stand as a monument to his success that he may ever think of with satisfaction and pride. But the root canal filling buried deep beyond the sight of man can never appeal to the same sense of pride and call forth such a display of patience and industry unless it be brought into his vision, its good qualities revealed and its defects left to gape and stare at him every time he thinks of that tooth or the patient for whom he may have labored almost to the limit of his endurance.

[1]Dr. F. B. Moorhead, Journal A. M. A., 1916.

[2]Dr. A. D. Black, Journal A. M. A., Aug. 25, 1917.

We must admit that sooner or later every patient will be subjected to X-ray examination for some purpose and then the test will come, so why not make this X-ray examination the requirement of every root canal filling before continuing further work upon the tooth or allowing credit for the root canal filling?

In reply to letters sent to each college of the Institute, I received thirty answers stating as follows: nine require radiograph record of every canal filling; eleven require radiographs from a small per cent to fifty per cent of their canal fillings, while the other ten make no requirement at all. Three replies included a statement that it was to be a requirement in the near future.

The possibility of failing to completely fill a canal even tho thoroly open to the foramen, is quite usual even to an experienced operator. Very frequently two or more attempts must be made before a perfect result is obtained. Where the radiograph is not made there would be no evidence to show the need of a second attempt; hence, many accessible canals would be left imperfectly filled and there would be little progress in this work.

### The Equipment.

It is most essential that the student is given the proper equipment with which to operate in root canals. It cannot be safely left to dental supply dealers to select the equipment altho the dealers are glad to co-operate and many times may suggest to the department to advantage. Where there is a published list of required instruments and the student purchases all, he enters upon his work well equipped, but it is difficult to impress upon many students the need of replenishing the stock at all times before it becomes exhausted.

In some schools it is a general practice to furnish a new broach with each operation so that the student may not want for proper equipment. However, my experience has enforced upon me demands for such a varied number of different broaches that it seems impractical to furnish the broaches to the student.

We suggest the following list of broaches and other equipment for this work:

Equipment for Root Canal Technic.

Broaches.

*Barbed.*

XXX Fine regular
XX Fine regular
X Fine regular
Fine regular x
Apexographer

*Smooth.*

XXX Fine regular
XX Fine regular x
X Fine regular x
Fine regular x

*Mounted on Aluminum Handles.*

XXX Fine barbed short handles
XX Fine barbed short handles x
X Fine barbed short handles x

*Kerr Pulp Canal Files. x*

XX Fine short spiral
X Fine short spiral
Fine short spiral
Medium short spiral

*Friedman Germania Broaches. x*

XX Fine short spiral
X Fine short spiral
Fine short spiral

x 1. Metal broach holders
2. Gates—Glidden drills, small, medium and large
x 3. Root canal pluggers Nos. 34, 36, 38 and Kerr No. 1
4. Platinum wire loop—20 ga. mounted in glass rod
x 5. Medium flat file and filing block
6. Sterilized cotton—Johnson & Johnson
7. Cotton pellets—sterilized
x 8. Aseptic napkins
x 9. Absorbant canal points—Johnson & Johnson
10. Gutta-percha canal points
11. Covered chlora-percha bottle

xRequired equipment.

12. Bottles with ground glass dropping stoppers
13. Screw top bottles for surplus sterilized broaches
14. Minum trays
x15. S. S. White medicament tray

STERILIZATION.

The problem of sterilization in the Infirmary clinic is one of great proportions, and when we undertake to carry on a practical and thoro method which will include root canal equipment, we have added much difficulty to this problem. I have stated before in this paper that to have the equipment sterile to begin with, does not insure it against contamination and I believe the difficulty of *maintaining asepsis* thruout an operation of this kind is even greater than that of initial sterilization. All broaches, broach holders, pluggers and other metal instruments may be boiled in the usual Infirmary sterilizer. There is some difficulty encountered here, as there are so many small instruments liable to become lost. However, the broaches may be wrapped in a small piece of muslin or cheese cloth and kept in a small package while in the sterilizer and immediately spread out to dry when removed. Another method may be used, such as keeping the broaches while not in use, in a 10% solution of lysol. Either method will be abused by shirkers and careless operators and constant supervision is demanded to maintain regularity and to assist the student in cultivating good habits.

There seems to be at present no satisfactory method of sterilizing cotton, dressings and gutta-percha canal points for Infirmary use. Some schools are using the Penz sterilizer, others the autoclave and a few are attempting to sterilize with formaldehyd, but the great majority are making no effort to sterilize these materials, and I doubt if any of these methods mentioned above are desirable enough to become universally used. The reply received from the Northwestern College of Dentistry offers a very possible solution for this problem in the plan under way for their use. The plan consists in dry heat ovens heated by electricity and controlled by thermostat in which all materials for root canal operations may be kept sterile and given out to the students for each operation. Gutta-percha points can be sterlized with dry heat, allowed to cool and then cut for use as needed, or they may be kept immersed in alcohol; however, the former method is more efficient. There is necessarily quite a little work connected with the proper sterilization of these materials and it requires a competent nurse to take charge of it whose time will be very well occupied with these duties and associated duties of distribution of the materials.

There is a certain routine of sterilization which must become a habit with the student or operator before it really becomes a part of the regular operation. I have watched the boys in the Infirmary and have found it to be as customary for some to be particular about these details as it is for others to be careless, and it is no different from other habits these boys form. If a method of regular sterilization can be adopted that is simple, but *efficient* and *practical* and the habit is well formed while they are in training, the probability of careful work after graduation is much greater.

In connection with the sterilization of broaches I wish to mention here as well as later in my paper that the equipment is not complete without a suitable tray for medicines to be placed upon the operating table. The S. S. White Mfg. Company have a medicament tray which is most useful for this work. It has suitable grooves and concavities for several drugs in one of which alcohol may be kept and another phenol solution and each time before the broach is inserted in the canal it should be immersed first in the phenol and then in alcohol and touched upon a dry, sterile bit of gauze

xRequired equipment.

to absorb the moisture before using. If this routine is faithfully carried out at each operation, I believe the danger of infection from broaches would be overcome to a very large extent even tho there were a failure with the boiling or a contamination during the operation.

The cotton for use in these operations should be sterile. One way this can be accomplished is by having the student apply for sterile cotton for each operation. Very little cotton need be used in root canal work, as it is neither necessary nor advisable in my estimation to use anything but absorbent paper points in the canals. Wrapping cotton upon a broach is a treacherous procedure and one that can be easily omitted, thus avoiding the danger of infection from this source. There is a need for a suitable dry oven sterilizer for Infirmary use with a practical method of distribution of the cotton, absorbent points and gutta-percha points. The care and details involved would be quite burdensome but it seems to me the importance of the result would justify the trouble.

OPENING AND CLEANING THE CANAL.

Since it is impossible to include within the scope of one article on this subject every phase of the work involved in root canal operations, it is necessary to omit some important features and slight others in order to give proper emphasis to the selected ones. I shall not attempt to take up the matter of pulp devitalization or anesthetization, nor the treatment of various pulp conditions found but will confine the paper to the subject given me on the technic involved in root canal operations.

The first requisite in teaching this part of the work is that of having efficient assistants, thoroly trained to carry out the teaching in the clinic. There should be co-operation and complete understanding between all in the department which can only be possible where there are frequent conferences of the staff. The teaching of the lecture room alone would be very inadequate because of the lack of experience and inability of the student to grasp so many details and retain them. The strength of the teaching is developed when the student is operating and his mistakes can be detected and pointed out, and misconceptions of the teaching may be corrected. In the lecture room the desired technic can be given by explanation and illustration, but instruction in the clinic while the work is being done impresses the student mind so deeply that he never forgets. I do not give all the class room work on this subject at one time, but at the beginning of the year outline the technical procedure, and later in the year take up the detailed study of pulp removal and canal filling, and review the technic again. This allows the student to profit by some practical experience and gives him a better understanding and appreciation of the instruction on this very important subject.

I will now proceed to give a description of the technic used in the University of Illinois, School of Dentistry.

*Asepsis.* Repardless of the condition present within the pulp chamber and canals, the same aseptic precautions should be taken. The mouth should be sprayed and the gum and adjacent teeth painted with tincture of iodin. The rubber dam should always be placed to isolate the tooth, and the teeth included thoroly washed with alcohol and painted with iodin again. The equipment all sterilized and all supplies ready upon the tray, the tooth may be opened and should be treated with the same degree of care that a surgeon would treat a wound upon some other surface of the body. If we wish to prevent the awful condition found by radiograph at present, from being found in the future as a result of our present methods, we must eliminate the uncertainty and carelessness from these operations. The instruments and materials must not be handled and they should always be sterile. If the precaution of dipping the broaches in phenol and then in alcohol, is faith-

fully adhered to during the entire operation and the sterile materials are not contaminated by handling or by coming in contact with any septic matter, there is a splendid opportunity for an aseptic operation.

*Access to Canals.* This is a very important step in the successful outcome of the operation. I know of no better means of impressing upon the mind of the student the purpose of gaining access to the canals and the extent of necessary cutting, than by lantern slide, chart or drawing to illustrate. The fact that this has not been sufficiently impressed in the past is made very evident in the radiographs where we see pathetic results in patients' mouths from imperfect root canal work due to attempts to operate around obstructing walls that should have been cut away before an attempt was made to clean the canals. Cutting away obstructing walls and angles at the beginning saves much time and removes a difficulty which might make a failure of the entire work upon the tooth if allowed to remain. The canals should be in plain sight before the broach is put into them. To enable entering the canal easily the Gates-Glidden drill can be used to make a funnel shaped entrance, but it must be used with extreme care. It is very desirable to have a radiograph of the tooth to aid in gaining access without injury to the root and also to observe the number of the roots and the position in which they lie.

*Filing and Curetting.* The process of enlarging the canal is one that requires great patience and much time. The first step is to pass the smallest smooth broach to the apex of the root and make a mark or bend in the broach to indicate the length. This serves as a guide in the work following as to the length and direction of the canal. This broach is laid aside where it can be referred to constantly while working. Should the canal be a large one it is often possible to clean it completely with barbed broaches and prepare it for the filling, but where the canals are small and curve as they frequently do in the mesial root of lower molars and buccal roots of upper molars, first upper bicuspids and occasionally cuspids and lower incisors, it is necessary to work with great care to avoid accidents, such as losing the canal or plugging it up with debris or leaving part of a broach which is most unfortunate. Wherever the finest smooth broach will pass it is possible to enlarge and fill the canal unless an accident occurs which should be avoided. Where the canal is extremely small and curved, the entire operation must be carried on by the up and down motion with no turning or twisting of the broach around and around. Smooth broaches may be rolled between a medium coarse file and a block of wood to make a rat-tailed file of them in the graded sizes and with the aid of 30% sulphuric acid, the extremely small and curved canal may be enlarged and straightened enough to allow the smallest Kerr file to pass which will cut quite rapidly. It is preferable not to use the acid with anything but smooth broaches, as it weakens them and accidents may more easily occur. The acid should be neutralized with a saturated solution of sodium bicarbonate. This process of neutralization causes effervescence and brings much debris from the canal. Every time the instrument is inserted in the canal, it should be passed to the apex of the root and the canal enlarged thruout its entire length constantly to avoid losing the canal. The process of enlargement and curettement should be carried on progressively and consecutively with each size broach one by one until the larger sizes will pass to the apex. Should the operator become impatient and skip a size or two at a time, the result will usually be a failure, as the larger sizes will not pass to the apex and soon a ledge is made where the canal curves and the canal is lost and rarely ever can be found again. The barbed broaches and files should be used alternately, for curetting and rak-

ing out the fillings and debris. This process should be continued until the canal plugger No. 34 or Kerr No. 1 will pass to within two millimeters of the apex.

*Measure Wires and Radiograph.* When the canal has been enlarged and is about ready for the filling it is advisable to place wires in the canal cut so as to reach from the apex of the root estimated as near as possible, and flush with the surface of the cavity and a radiograph taken to check up the work to this point. It is quite important to have the measure wire flush with the surface of the cavity to avoid the difficulty found where the radiograph causes a distortion of the size of the tooth, as it is much easier to deduct the amount of distortion where at least one end is flush.

The process of enlargement and currettement is usually too long for one sitting and it necessitates sealing the cavity and continuing at other subsequent sittings. The sealing of drugs in the tooth for disinfection of the dentin is not as important as the mechanical filing and curetting that should be done before filling the canal. Only such drugs should be sealed in the canals as will cause no injury to the soft tissue. Sealing should be thoro to prevent ingress of moisture and this can best be done with both cement and gutta-percha together, one over the other.

## Filling the Canal.

In filling root canals the uncertainty of the operation has always been a great handicap to the operator. Many conscientious operators have felt assured of a good filling in the past when they sealed up the tooth after having had a good response from the patient while filling the canal and the result of this uncertainty is the cause of the unfortunate condition we find so often around these root ends today. If we can eliminate as much as possible of the uncertainty and depend upon measurement and quantity of material, there will be better results.

When the canal is ready for filling, the plugger No. 34 or Kerr No. 1 will pass to within three millimeters of the apex of the root. This is determined by the length of the measurement wire and radiograph which should be before the operator. The plugger should be marked so as to serve as a guide to indicate when it is in the canal the proper distance.

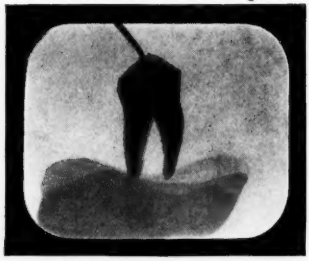
*Dehydrating.* The canal should be dehydrated with alcohol followed by warm air and absorbent points. It is much safer to depend on these points than upon sterilized dressings wrapped on smooth broaches since there is always danger of contaminating these dressings when using them as they so often come off or loosen and one is tempted to take them in the fingers. Another advantage in using the absorbent point is that the end may be clipped off to measure the diameter of the foramen to use as a guide in selecting the proper sized gutta-percha cone for plugging the foramen.

*Filling.* Having selected a cut piece of gutta-percha cone of such a size that it will not pass thru the foramen and slightly longer than the two millimeters of space between the end of the plugger and the foramen, it should be attached to the end of the plugger by slightly heating the plugger and touching it to the cone. The canal should be slightly moistened with eucalyptol followed by one drop of thin chlora-percha carried well to the apex. The plugger carrying the cone is carefully inserted and pressed into the canal until the mark is flush with the surface of the cavity, the landmark which was selected. Now we have a two millimeter space with a fairly accurate estimate of the diameter to be filled with a carefully selected piece of gutta-percha and a small amount of chlora-percha for lubrication and surplus. The only space that need concern the operator seriously is reduced to a minimum and a fairly close estimate of its capacity can

Figure 1.

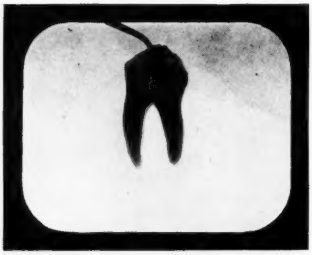
Extracted tooth with canals enlarged for filling. Measurement wires in place flush with occlusal surface of cavity as landmark.

Figure 2.



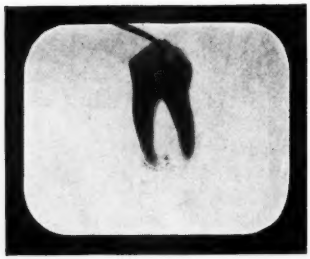
Extracted tooth with root canal plugger No. 34 inserted should always be within two millimeters of foramen. Plugger bent at occlusal landmark for guide.

Figure 3.



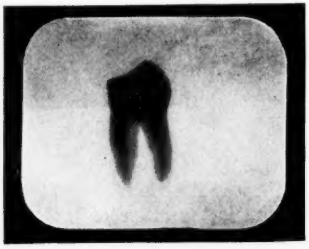
Extracted tooth with plugger carrying 2 m. m. cut gutta-percha cone to plug foramen. Canal previously moistened with eucalyptol and single drop of chlora-percha. When bend in plugger reaches landmark, foramen will be sealed with gutta-percha.

Figure 4.



Extracted tooth with plugger carrying cut gutta-percha cone pressed even with landmark and foramen sealed. By accurate measurements the same result can be obtained in the mouth.

Figure 5.



Extracted tooth with root canals filled. Foramina of mesial root are on the side of the root.

Figure 6.

Student K. First attempt to fill. No measurement taken. Filling had to be removed.

Figure 7.

Student K. Same tooth, filling removed and wire inserted for measurement.

Figure 8.

Student K. Same tooth, second attempt to fill. Root well filled. Little excess.

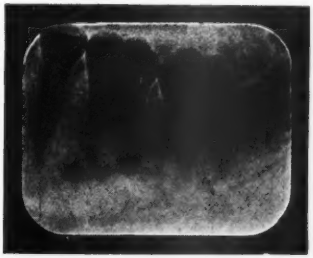
Figure 9.

Student O. Canal well filled by measurement.

Figure 10.

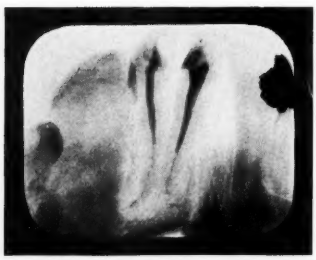
Student O. Canal well filled by measurement.

Figure 11.



Student O. Canal fairly well filled but not packed sufficiently.

Figure 12.



Student W. Canals filled but not packed sufficiently. Canals should have been enlarged to accomodate plugger to at least 3 m. m. from foramina.

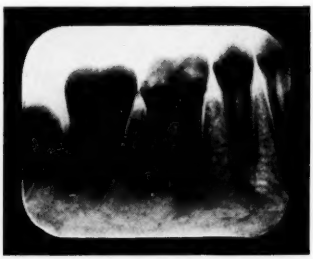
Figure 13.

Student G. Canals well filled by measurement. Very little excess altho large foramina.

Figure 14.

Student G. Canals well filled by measurement. Very little excess altho large foramina.

Figure 15.



Student G. Canals well filled by measurement.

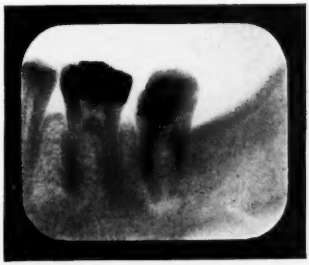
Figure 16.

Student Q. Canal only partly filled. Student failed to enlarge sufficiently. Filling to be removed.

Figure 17.

Student Q. Same tooth. Filling removed, canal enlarged. Gutta-percha packed to foramen.

Failure 18.



Student T. Result of twisting broach or reaming canal with force. Failure.

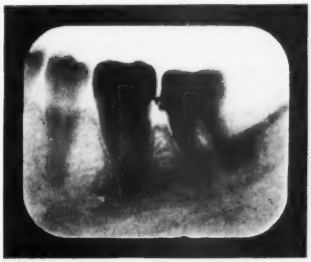
Figure 20.

Student C. Bicuspid canals well filled by measurement.

Figure 19.

Student C. Molar canals well filled by measurement.

Figure 21.



Student C. Second molar canals well filled by measurement.

be made. Should the cone at the end of the plugger not be lost on the way into the canal when the mark is flush on the surface, the space will be filled full. If there should be too much liquid only a small portion will be forced thru the foramen and probably such a small portion that it will do no harm. The cone should be carefully packed and then other short pieces of cut cones, two to three millimeters in length, should be packed one by one into the canal until it is full. This gives a uniformly dense mass of gutta-percha which I believe is as impervious to moisture and bacteria as anything that can be used for filling canals at the present time. The success of the entire operation is to a very large extent dependent upon the first piece of gutta-percha cone that is packed to fill the apex of the root. Should that fail to reach and thoroly fill the space there, the remaining part of the filling would be of questionable value.

*Radiograph.* Every root canal filling should be radiographed to serve as a record as well as to inspect the work. Regardless of the experience an operator may have had there is no certainty about a root filling and many times two or more attempts will have to be made to get a perfect result. The radiograph is the only evidence we have in this work and it should always be used by the one who fills the canal to prove up the work. Every canal cannot be cleaned and filled

to the foramen, but unless every canal is filled as far as it is possible to clean it, the work is incomplete and should be done over, and the only way to discover this is by the use of the radiograph with measurement wires in place before filling and after the filling of the canal. The canal filling should not be passed upon by any other method of examination, neither should credit be given until inspected by radiograph. The basis upon which credit may be given to encourage the student should be in proportion to the time required to complete the operation. I would prefer to give the required number of credits for ten perfect results than for twenty indifferent ones, and I believe the student is far better prepared to care for the public who puts forth his greatest effort to obtain a perfect result and learns the price he must pay for success.

OUTLINE FOR ROOT CANAL TECHNIC.

1. Radiograph to show number, shape and direction of roots.
2. Asepsis.
    1. Wash or spray mouth.
    2. Paint gums and neck of tooth with tincture of iodin.
    3. Isolate.
    4. Wash teeth included with alcohol.
    5. Paint with tincture of iodin.
3. Gaining access to canals.
    1. Uncover entire pulp chamber.
    2. Cut away buccal, lingual and mesial walls to bring all canals into view.
    3. Cut away walls to eliminate all curves possible.
4. Cleaning and enlarging canals.
    1. XXX fine smooth broach (Pathfinder) to ascertain length.
    2. Large canals, barbed broaches to clean.
    3. To remove old gutta-percha filling—Xylol, explorers, spiral short broach.
    4. Small canals.
        1. XXX fine smooth broach file.
        2. XX fine smooth broach file.
        3. X fine smooth broach file.
        4. XX fine Kerr file.
        5. X fine Kerr file.
        6. XXX fine barbed broach to remove debris.
        7. XX fine barbed broach to curette and enlarge.
        8. X fine barbed broach to curette and enlarge.
        9. Fine barbed broach to curette and enlarge.
        10. Fine Kerr file.
        11. Apexographer or X fine barbed broach to remove debris.
        12. Sulphuric Acid 30% as indicated.
            1. Neutralize with Sodium Bicarbonate.
        13. Enlarge until No. 34 plugger passes to within 2 mm of apex.
5. Measurement wires and radiograph.
6. Dehydrating.
    1. Alcohol.
    2. Hot air.
    3. Absorbent canal points.
7. Filling canals.
    1. Mark length of canal on plugger.
    2. Measure size of foramen with absorbent canal point.
    3. Eucalyptol to moisten canal.
    4. Chlora-percha — very small amount.
    5. Cut cones, 1 to 3mm long, selected size.
    6. Attach proper cut cone to No. 34 plugger and plug 2mm space at apex.
    7. Continue until full—condense each piece thoroly.
8. Radiograph.

DISCUSSION.

*Dr. D. M. Cattell, Memphis:*

Not having seen a copy of the paper till just now I am not ready to discuss it, but I must say a word about my

friend Coolidge: *He has done it*—he has given food for thought. From the days when Callahan appeared before us until the present time Dr. Coolidge has interested me in a way a little beyond the usual man in the study of this subject. And, by the way, while I think of it, can any of you tell me when Dr. Callahan first published that he introduced something into the root-canal that would soften the walls so that he could scrape them there by enlarging the canal? You Chicago fellows, Odontographic men, remember that fifteenth anniversary of the Odontographic Society, the greatest gathering of dentists up to that time that had ever come together in the United States, even larger than the World's Columbian Dental Congress in '93. At that meeting back in the nineties Dr. Callahan of Cincinnati introduced the aqueous solution of sulphuric acid, fifty per cent, to soften the walls.

I marked seven of the paragraphs of Dr. Coolidge's paper as he was reading, and then checked off paragraph after paragraph and now I have them about all checked. I would like to comment on every paragraph, I would like to read it to you over again it was so good, for it says just what I would like to say. But a few points only will I touch upon.

"The possibility of filling a large or small canal perfectly even after thoro cleansing to the foramen, is uncertain." His words speak what we know to be true. The long years of practice, the difficulties we have had, and the surety with which we have felt we did our work well, have been so torn up and we have been so knocked over that we scarcely know where we stand now. Since the X-ray came to our help, we have been confronted with the fact that our earlier work was seldom perfect. We have found that there is no other operation in dentistry that requires more patience and persistence than the cleansing, enlarging, sterilizing and filling of root canals. Any operation that we have that we can see what we are doing is more agreeable, it is so much more to our interest and liking. And this thing of working hour after hour, sitting after sitting, before completion—we get tired of it, even the most conscientious of us get tired. And what, then, can we expect of the student? He is tired in a few minutes. We see them at the chair placing the rubber-dam and then sticking a little cotton around and going to work, and by the time you can get over to see if the canal is opened properly they tell you that the canal is filled and that they have commenced on the gold or amalgam filling or whatever it is, and it is nearly completed.

The Doctor has opened up a field for thought to those teaching operative dentistry that makes one rather ashamed of the amount and kind of work that has been insisted upon for the student to do. I feel as tho so much of my work in teaching has not been right, not thoro enough, and I believe that many of you can say the same.

I could only repeat what the essayist has said if I were to continue, however I want to emphasize this point: The use of the X-ray. I know that most of the schools have an X-ray machine; we have a beautiful one down there in Tennessee, one of the most expensive, but while we have not had the experience with it that some other institutions have had, we have great hopes for the future. The essayist showed us plainly what we have to contend with so far as the student is concerned and also what the student has to contend with, and he has shown us how difficult it is to get to the end of the canal. He has shown us many difficulties, but he has indicated the means whereby we may overcome them. I think this paper is the best of its kind covering the subject that has ever come before this body. I will admit the first half of it sounded as tho it should have been read before some state organization, but the last half appeals to teachers in their work with students, and I beseech for it a re-reading when it

comes out in print. There is more in it than appears on the surface, and the more we will read it paragraph by paragraph and see the difficulties in the way and the remedies that have been pointed out, the better teachers we will be when we get thru reading it the fifth, sixth or seventh time.

*Dr. H. M. Semans, Columbus:*

Dr. Coolidge has given us a very timely paper, in that we are confronted by a condition in dentistry which is probably the most serious now under consideration by the profession at large. This condition of affairs is one that has placed squarely before us the fact that, in an appalling high average of cases in general practice, non-vital teeth are constantly being placed in a condition which endangers life to a constant mortality. If this mortality cannot be lowered, then non-vital teeth must depart from our attention and care as a useful member of the dental function. The showing of bad results, as presented to us the past few years by our pathologists and others, almost makes us ready to throw up our hands and give the pulpless tooth the go-by. Almost but not quite.

Dr. Coolidge has just presented to us technical methods perhaps not new to any of us, but the way of going to the work has a new aspect; and this should receive our careful attention. Rules and regulations can be made to govern all procedures, but the method of execution can completely upset the results.

I would like to emphasize a few of the ways of carrying out these technical rules and regulations as given in this paper. All the way thru the paper there is constantly placed before us the fact that thoroness can only be had by a complete separation from everything else during the care and treatment of the canals. As the essayist says, the student in a large majority of cases will assume certain careless habits in his technical training unless constantly guarded. Our attention is called to the fact that an assistant or nurse, giving entire time and attention to the care and placing in the student operator's hands all materials, will go a far way in observing asepsis; yes, it will do more, in that the student has impressed on his mind a rigid rule not to be departed from, which is that asepsis can only be had by strict attention to what he is doing. Individually, perhaps, students can carry out asepsis by attending to the obtaining of materials themselves, but the chances for slips in procedures are rendered greater. I agree with the essayist that the radiograph should be constant in attendance, with the student work, both in showing what he does or does not do, as well as again impressing with the thought of a constant desire for thoroness. Dr. Coolidge impresses us with the idea of constant care and thoroness to the extent that more and more time must be given over to the canal during its care and restoration. To this I am agreeable also. The day has gone by when we might argue that the pocketbook of the patient governs our time spent on what we may be doing for said patient. We are professional men, and servers and savers of human life today, and in the future, only in proportion to the painstaking care we give to our work. We are right now confronted with the fact that time, care, and attention must be driven home to both the operator and the patient, in all canal procedures. If we, as operators, should show any impatience to our patients, it is when they refuse to recognize that the financial obligation is a large matter, rather than a small matter. As Grover Cleveland once aptly said, "We are facing a condition, gentlemen, not a theory." This condition is the tremendous importance of canal procedures. I have my doubts whether we should allow this work to be done out in the operating clinic room. The seriousness and the sacredness of the work would undoubtedly be increased in our students' minds should we require a separate operating room for such work, with separate service and instruction and

guidance. Our fundamental technical training also can go a long way in teaching the importance and care, and care and then more careful attention.

Dr. Coolidge dwells principally on the work done for the canal in the patient's mouth. The technic-room work no doubt can go a long way in getting effective results in the clinic.

The essayist has placed before us an interesting array of instrument equipment. The personal equation enters into such equipment, its variation, number of articles required, and method of dispensing. For my part I like the dispensing of broaches by the college for each individual case, but constant care must be observed to avoid such dispensing, and it probably, if done thoroly, would require separate and individual attention as to assistant nurse and instructor attention.

Taken in all of its phases, the paper is so comprehensive and so thoro that I could well remain silent in discussion, and let it rest on its merits.

*Dr. Fred W. Gethro, Chicago:*

You have listened to a well written comprehensive paper on the teaching of root canal treatment and root filling compiled by one of our best teachers. The methods suggested are sound and will stand the light of closest examination. They are the combined result of a well trained, hard working student of this particular subject plus the experience of a most careful and conscientious operator.

The outline presented is so nearly parallel to the course given at Northwestern University Dental School that I could quite appropriately make a very brief discussion by saying—well done. There are, however, a few points that might be elaborated on and some that admit of discussion. The introductory remarks of this paper suggest the necessity of the teacher realizing the importance of the service rendered and its vital relation to the health of the individual, etc. If a teacher is to present this subject and get the greatest amount of benefit from the study of the subject, he must first be fully alive to the great importance of the subject; second he must be able to stimulate, encourage and inspire the assistants and demonstrators as well as the students of the classes. He must be able to present the subject matter with that strong enthusiasm born of actual experience. If it is true that a large percentage of our failures are with the larger and more accessible canals what is the reason? Many believe that it is because the average operator is carrying infection to those canals and perhaps carrying infection thru the foramen due to the accessibility of these larger canals. If this is true it is a sad commentary on the knowledge and skill of the average operator.

In my opinion there is no department of dentistry in which the profession is so deficient as the one we are considering. If this is true we must realize that great effort must be put forth to correct this evil. If we are to strike at the root of this condition we must begin with the dental school. There must be more effective teaching, there must be unbounded enthusiasm which should permeate the whole faculty and to get the best results there should be uniformity in teaching and practices of the various members of the faculty. There are too many differences of opinion at the present time in reference to root treatments and fillings and there is nothing concrete to present to the students. Faculties ought to get together thrashing out their individual ideas and evolve a method that all can recommend from a teaching standpoint. This is team work and the only effective way of teaching.

A teacher of root treatment and filling is not doing his full duty to his students unless he deals with all phases of the subject. He must prepare his students to a full realization of the difficulties usually encountered and he must analyze the various reasons for these many failures. The average fees received for this class

of operating is out of all proportion to their value and importance. No discussion of the subject is complete without reference to this unfortunate condition. A surgeon can frequently perform one or more major surgical operations in the same time taken for the treatment of root canals of a single tooth. There can be no doubt but what this particular point of poor fees is largely responsible for the poor results obtained in the treatment of teeth. The entire blame for this condition must be placed on the dental profession. If the profession realized the importance of this class of operating and educated the public, educated their patients, that part of the problem is solved. Any opinion held by the public on questions of this nature is but a reflection of the teachings of the dental profession.

I differ with the essayist on a few minor points and will refer to them very briefly. Instead of using iodin on the teeth and surrounding tissues prior to the adjustment of the rubber dam, I recommend the thoro cleaning of the necks of the teeth by instrumentation followed by clean warm water in a good syringe capable of forcing a strong stream of water thru the interproximal spaces. The use of the various mouth sprays—iodin, etc., is unnecessary.

I am absolutely opposed to the use of the Gates-Glidden drills, not only for students but also for the average operator. It is a very dangerous instrument. I believe that practically all root curettement should be done with the barbed broaches. It should be remembered that there is the greatest difference in barbed broaches. Most barbed broaches are not sufficiently tempered to be effective cutting instruments for the curettement process. A barbed broach that is pliable and will bend and twist without breaking is practically useless for this procedure of curettement.

This subject is so broad and includes so many details that in order to include the points that I want to make I am compelled to summarize as follows:

1. Strict surgical cleanliness. Rubber dam always necessary.
2. Thoro curettement.
3. No strong medicine within the canals at any time. No strong acids—no arsenic. This means never use any drug that could possibly injure the delicate tissue at the end of the root.
4. Every treatment hermetically sealed with base plate gutta-percha. No temporary stopping—no sandarac varnish and cotton or similar fillings. Treatment is never started until filling hermetically seals cavity.
5. Good radiographs establishing correct lengths of roots.
6. No instrument of any kind or anything else should ever penetrate the foramen.
7. The natural constriction at foramen should ever be enlarged. It is a most important guide in the removal of pulp and the filling of the canal.
8. Alcohol and dehydration unnecessary.
9. Eucalyptol should be used sparingly in the canals for the following reasons. It is a solvent for gutta-percha, a lubricant, it removes moisture and is an antiseptic.
10. The less chloro-percha one uses the better will be the filling.
11. Roots should be filled as soon as clean and sterile.
12. Two or three treatments at most and these usually completed within two or three days.

The chief lesson to be learned is that the removal of pulps and the subsequent treatments and root fillings are always uncertain. Therefore pulp conservation is the most important thing in preventive dentistry. The only safe root filling is a normal healthy pulp.

*Dr. A. E. Webster, Toronto:*

I want to say just a few words in connection with this subject. I regret that Dr. Coolidge's paper did not come up in connection with my paper so that they could have been discussed together.

The essayist makes the remark that

there is no possible means of sterilizing effectively in the infirmary. But it is all very simple if we require each student to have his own sterilizer and conduct the sterilization as he would do it in his own office. There is no difficulty in having the student make his own equipment dressings if you please, or have the nurse prepare the paper points and the cotton and all and put them up in little packages, pinning them together and putting them in the sterilizer, when they are sterile at all times for use. In addition to that, he should operate from his sterilizer and not from any place around, taking what is necessary out of the sterilizer just at the time he is ready to make the operation, having the nurse present when the cotton rolls are opened up for the first time and exposed. It is all very simple, it is quite feasible.

In connection with the technic, we have heard the discussion of this subject from the infirmary standpoint. Gentlemen, if that is all the technic and X-raying that is needed by our students, then we are precisely in the same place that we were before Dr. Black originally introduced dental technic in dental colleges. Why should patients suffering have root-canals treated by a novice? Unless he has done the same operations and with the same aseptic precautions some place else before he came there patients must get poor service. For instance, why should not that student have made X-rays of teeth in the laboratory, as was shown by Dr. Gethro? Such exercises should be done under the same aseptic precautions as in the mouth. Can you expect a student, the first time he treats a patient, to be clean all at once after slopping around the laboratories for a year? It is impossible! To be clean is one of the most difficult things the whole human race has to accomplish. When you think of the efforts we make to be clean, and then expect a student who doesn't know anything about it, just as soon as a patient is presented to him to be able to follow the full ritual. He cannot do it. I have seen in our courses in the laboratory between 1500 and 2000 X-ray photographs of fillings made in the last year by our students. They are just like the ones we saw in the pictures shown here. First the student X-rays six teeth, next he opens them up and clears out the root-canals, puts the wires in and X-rays again, third, fills the root-canal and X-rays again, then files the roots down and looks at them. Now, the X-ray picture and the filled specimen do not always coincide by any means, and when we say to the profession: Here is the X-ray, the root-canal is not filled to the end. This man is guilty—it is all bosh. The X-ray does not show whether it is filled or not. It is so easy to be mistaken. We ought to be honest with our students.

*Dr. Daniel H. Squire, Buffalo*:

It is seldom that one has the privilege of listening to a paper which more clearly defines the method of teaching a subject, accompanied by a faultless technic, than the one which has been presented by Doctor Coolidge. It contains a very earnest plea; first, for a realization on the part of the student and I may add, on the part of the teacher also, that this work is of a different character than other operative precedures which are performed in the infirmary clinic; second for the creation in the mind of the student the value of accurate technic; third, the desire to gain a result which will maintain bodily health.

The first item may be answered by placing pulp canal work in a room set apart from the general infirmary clinic, thoroly equipped with X-ray apparatus and methods of sterilization. The psychological effect upon the students in going into another room under a surgical environment is of great value and quite sufficient in making him understand that this work is different in character from that of making a crown or the filling of a cavity in a tooth. He comes to this room for a special purpose, another branch of dental education is opening before him with its particular method

of technic and treatment. In this room are taught the surgical principles of cleanliness in a way previously unknown to him in the infirmary, because pulp canals are in close proximity to the deep structures of the face and necessitate aseptic treatment.

We are beginning a new era in the consideration of the dental pulp and its treatment. Its importance both in health and disease have grown with our knowledge of its relation to the vital processes of the body. It has never been given much prominence in the didactic teaching. In the college which I have the honor to serve we have begun with the didactic and the technical courses in operative dentistry with the teaching of the dental pulp. We desire the student to realize at the outset that the pulp is a living thing, that it occupies a certain position within the tooth; that it is always present and can be reached with a bur. The student should understand that the pulp is the most important organ of the tooth and around it all of our technical operations are performed for its preservation. It is also impressed upon his mind at this time, that when the pulp is dead it becomes equally important as a focus of bodily infection.

The drawing of the pulp in situ, then reproducing it in plaster relief, bringing out with oil paints its structure, will do much toward creating an interest in tooth dissection and pulp canal technic. It has been my experience, if other technic is presented first, that the pulp is considered secondary and will always remain in this relationship.

In consideration of the second point, that of creating a desire for accurate technic, I feel that there is too much attention paid by the student and also by many demonstrators to the number of points to be gained, rather than the quality of the work. In the treatment of pulp canals a case is either a success or a failure, therefore, I see no reason why partial credit in points should be given. I would rather that a student should fill half a dozen pulp canals, under proper instruction, carrying out every detail of asepsis, curettement and filling than to have a hundred points to his credit. Let the X-ray mark his progress and give him credit.

The desire of accurate technic on the part of the student will come thru the close supervision of the teacher in training him, not only in technical procedures, but in the liberal use of the X-ray, the sterilizer and in the keeping of a record of the results of each treatment. The student can only be taught the value of these things thru actual contact with the teacher. I do not mean that the student should watch these procedures, but that he should understand the mechanism of the X-ray machine, take the radiographs before and after treatment, attend to the sterilization of his instrument and keep an accurate record of the procedure. One of the great faults in dental training is that there is insufficient teaching at the chair and too few demonstrators are employed to do the work properly.

Coming to the third point raised in the paper; that a student must desire to gain a result in his treatment which will maintain bodily health, I wish to emphasize the fact, that if he has had the benefit of the personal touch of the teacher in all of this scientific training, he cannot help but show an interest and a desire for success. On the other hand, if he is still indifferent, he does not possess those qualities of character and mind which a student of dentistry must have, and should be advised to discontinue his studies. The time has long past when dental colleges should train men for the price of their tuition alone.

The technic requirement, which Dr. Coolidge has outlined, is quite unusual, but it comes nearer to that used in a modern dental office and I feel that we should teach our students the value of such an equipment. At Buffalo, we still furnish broaches to our students.

It insures a new broach for each operation and when a student furnished his own he never gave them up until they were left in pulp canals, and we have a demonstrator to fifteen students in the pulp canal clinic. I am much in favor of the use of files for enlarging pulp canals. The up and down motion of the file is less hazardous in the hands of a student, than the use of the barbed broach, as it seems almost impossible to teach a student that a barbed broach should not be twisted round and round in the canal. I do hesitate to allow the use of the Gates-Glidden drill in the clinic, unless a demonstrator is watching the student and is perfectly sure that the student has his eye on the drill.

I agree with the essayist in the use of paper points, as they may be passed along the canals with less danger of foreing dead material thru the apex of the root, than it would be possible to do with cotton wound upon a broach. Paper points also absorb moisture much more quickly and thoroly and give one a better idea of the size and length of the canals.

Gaining access to the pulp canals is most important in this work and a good rule to follow is that the walls of the opening should be made parallel with those of the pulp chamber.

There can be no exception taken to the technic of curetting and filling pulp canals as laid down by Dr. Coolidge. On the other hand it can be commended in every detail. It is a technic which has been advocated by leaders in our profession and why not give the benefit of this experience to the student.

I do feel, however, that some discrimination should be shown in regard to the probable success of this work as cases are presented for treatment in the clinic. We do not wish our students after they begin dental practice to advise pulp canal treatment irrespective of surrounding conditions.

Team work in the clinic has been mentioned in the paper and I believe that this is the foundation of the success of all clinical teaching. The relationship of the professor and the demonstrator must be in accord with a definite line of teaching. The heads of departments must soon realize that teaching at the chair is absolutely imperative and it is my opinion that the time will soon come, if it has not already, that one clinical teacher in any department will have no more than fifteen students under his care and that this work will be further supervised by a critic, who shall pass from chair to chair thruout the clinic examining the different cases, criticising and aiding the demonstrator in carrying out the different methods of instructions.

*Dr. E. D. Coolidge, Chicago*:

Just two words, one in regard to the first half of the paper being addressed more to the members of a state society than to the body of teachers. I thought it would be necessary to deal with the subject partly as if I were speaking to operators themselves, and therefore I made the first part of the paper to appeal more to the man who was teaching as if he was a man also practicing, because unless we practice root-canal work we will not be able to appreciate the difficulty a student will have in his attempts to get what we want him to do.

The second point I want to speak of is in regard to what Dr. Webster said about technic. We do have that, but I omitted it because my thought was so intent upon another phase of the subject that the paper grew too long without mention of that feature, and I did not realize until it was being typewritten that I was omitting that part of the teaching. We do in our school have the same form of technic teaching except that we do not do it under aseptic precautions, but I think that is a good thing. The student does all this work on specimens, and I presume they are filed, I am not sure. I believe it is a good point to file them down afterwards to see the result of the filling operation.

# THE CHEMISTRY OF SILICATES AND THEIR APPLICATION IN DENTISTRY.

By C. C. Vogt, A.B., A.M., Ph.D., Mellon Institute of Industrial Research Pittsburgh, Pa.

(Read before the National Dental Association at Its Twenty-First Annual Session, New York City, N. Y., October 23-26, 1917.)

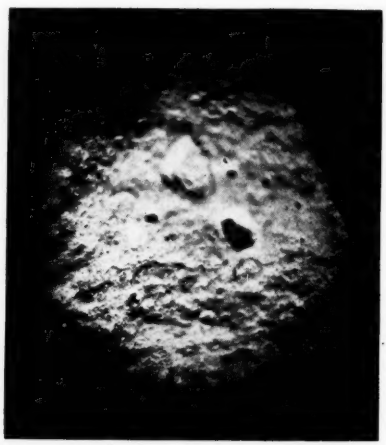
THE object of this paper is to bring before you the chemistry of the silicates, pointing out some practical illustrations which may be derived from these theoretical considerations. It is evident that the more complete the knowledge of the dentist concerning the physical and chemical properties of the materials with which he works the more nearly will he approach perfection in the principal application of them.

A silicate filling material consists of a powder and a liquid which are to be mixed according to more or less definite instructions.

## POWDER.

*Constituents.* The usual constituents of the powder of a silicate are silicon dioxide, calcium oxide, aluminium oxide, sodium and potassium oxides and fluorine. Oxides of other metals such as zinc, magnesium, beryllium, strontium, etc., are sometimes used. Nonmetallic oxides or acid anhydrides, as, for example, the oxides of phosphorus, boron, and titanium may also be present.

The development of a material of the silicate type was due to the demand for a translucent filling material which could be inserted while plastic as is the case with a zinc cement. Such a material would equal porcelain in appearance, and, since it could be inserted in the plastic state, the technic employed in its use would be far more simple than that required for the porcelain inlay. A product possessing these desirable properties would be a welcome addition to those in use before the silicate was discovered.



Microphotograph of an oxyphosphate of zinc cement pellet.

Examined under the microscope, a hardened pellet of oxyphosphate of zinc shows that there are masses of translucent zinc phosphate which hold together the opaque grains of the zinc oxide. Had it happened that zinc oxide itself was translucent there would have been no need for the silicate.

The problem was, therefore, to find a

substance which, being translucent itself, would act as the basis of the powder. A study of the metallic oxides—and because of their basic properties the oxides are the only compounds available for the purpose—showed that calcium and aluminium are the ones best fitted for use. But calcium oxide is both opaque and too caustic so that it must be modified before it can serve as a basis for the powder. Precipitated aluminium oxide, i. e., aluminium oxide plus water, which has been dried at a low temperature makes a very adhesive mass when combined with the phosphoric acid in the cement liquid but it also is too opaque and lacks density. If the aluminium oxide is heated strongly in order to increase its density it becomes so inactive chemically that the powder and the liquid will not react, so it too must be modified. Therefore one must subject these oxides to a treatment which will not destroy their ability to react with the liquid but will produce a profound change in some of their properties.

A study of the translucent porcelain tooth reveals that it is composed of aluminium oxide, sodium and potassium oxides and silicon dioxide, so this gave a hint of how to combine these materials and the combination of calcium oxide with these components was logically the next step in the process. Now the problem resolves itself into how to put all these materials into a translucent melt which would react with the liquid.

Since calcium oxide and aluminium oxide are both basic oxides which react with the acid quite readily it is evident that the melt must be one in which the proportion of basic oxide is greater than that of silica, an acidic oxide. After a melt of this kind has been worked out it is found necessary to add some additional components such as fluorides in order to aid in fusing at a low enough temperature to keep the aluminium oxide in such a condition that it is chemically active while the melt remains translucent.

The method of production of a silicate powder is, prepare a strongly basic silicate which is itself translucent. Because of its basic properties this material will readily react with the liquid and being translucent itself it will form a translucent mass with the translucent binder.

The various components are sifted and mixed, then fused at a temperature of 2000 degrees to 2500 degrees F. to a homogeneous liquid. The resulting melt is poured out from the crucible, the frit is ground in ball mills, sifted thru a fine sieve and is then ready to use.

*Composition.*—The actual chemical composition of this fused material is not known—it being an extremely difficult problem to determine the definite chemical individuals in an amorphous solid. The constitution of such long-known substances as porcelain and glass is not known exactly despite years of investigation and they are less complex than the melt for a silicate powder. There are to be found in a silicate powder, probably, calcium aluminium silicate, sodium and potassium aluminium silicates (feldspars), along with fluosilicates and in some cases borates, phosphates and titanates. However, this much is certain, that the melt is essentially a strongly basic silicate, i. e., one in which the percentage of metallic oxides or their equivalents is very high. This must be true in order that the powder and liquid may react freely.

### Liquid.

*Constituents.* The liquid is made of phosphoric acid diluted with water to which one or more metallic oxides have been added. These oxides are added in such quantities that they dissolve completely in the acid solution. The oxides added are those of calcium, strontium, beryllium, zinc or aluminium.

The purpose of adding these metallic oxides is two-fold:

(1) To reduce the acidity of the liquid. The interaction of the metallic

oxide or oxides and phosphoric acid forms a salt and water thus using up a part of the free acid.

(2) To regulate the rate of setting of the mixed silicate. The presence of the dissolved oxides which, when dissolved, form the corresponding acid phosphates, decreases the rate of setting.

*Composition.* The liquid consists of a concentrated solution of metallic acid phosphates along with some free phosphoric acid.

*Reactions during mixing.*—When the powder is added to the liquid the following reactions probably occur:

1. The metallic oxides or their equivalents in the powder react with the free acid in the liquid to form water and the acid phosphates of calcium and aluminium.

2. The acid phosphates formed in the first reaction and the acid phosphates already present in the liquid, react with more of the basic powder producing the normal phosphates and water. It is these normal phosphates which possess the adhesive and cementing qualities, hence it is evident that the greater the quantities of these salts which are produced during the mix the better the silicate. Consequently since mixing facilitates the interaction of powder and liquid, the more thoro the mixing the better the filling made from this class of filling materials.

Evidently one has to do with the reaction between a solid and a solution. This class of reaction is necessarily slow since the rate of any chemical reaction depends upon the number of molecules of the reacting substances which can come into intimate contact. Obviously only the surface of the solid can react with a solution. The reaction can be made more complete by stirring, just as salt will dissolve more thoroly when stirred because new molecules of water come into intimate contact with the solid salt.

EXPERIMENT TO ILLUSTRATE THE SLOW REACTION BETWEEN A POWDER AND A LIQUID.

(a) A solution of silver nitrate plus a solution of sodium chloride reacts immediately.

(b) Crystals of silver nitrate react only on the surface with a solution of silver chloride.

These facts make it evident that thoro mixing is very advantageous.

A second advantage of thoro mixing is that the acidity of the liquid is reduced to a minimum by the complete reaction between powder and liquid.

That there can be little danger of mixing a silicate too much can be proven by the following experiment: A powder made by crushing and grinding a hardened pellet will react with the silicate liquid, producing a coherent mass showing that not all the grains of powder have been completely acted upon in the first mix.

A third advantage of thoro mixing is the regulation of the evolution of heat during the chemical reaction. A definite quantity of heat is produced by the interaction of a definite quantity of powder and liquid. This is due to the heat liberated by the neutralization of the phosphoric acid by the metallic oxides in the powder. If the mixing is carried out too rapidly, this heat is liberated so rapidly that it becomes evident to the senses. On the contrary, if the mixing is slow and thoro the heat is evolved so slowly that it is readily taken up by the air. No one would think of adding a ton of coal to an ordinary household furnace at one time—he adds it by the shovelful and thus distributes the heat.

The *effect of the change of concentration* of the liquid is to *modify* materially the rate of setting of a silicate. Experiments demonstrate this so fully that I am going to illustrate this point by three mixes:

(1) Normal mix.

(2) Liquid plus phosphoric acid.

(3) Liquid plus water.

(1) represents a proper mix.

(2) sets too slowly.

This is the case when the stopper is left out of the liquid bottle. Some of the water evaporates and this concentrates the solution.

(3) sets too rapidly.

This is what happens when:

(1) The stopper is left out of the powder bottle and moisture from the air is absorbed by the powder.

(2) The slab takes up some moisture from the air on a warm, moist day or when the slab has been imperfectly dried. The cautions to be observed are too obvious to require enumeration.

### Hardening.

The hardening of silicates take place in two stages, the initial action is complete in 5 to 20 minutes, while the secondary hardening extends over a very considerable period of time: months and perhaps even years. However, the maximum change of physical properties takes place in 24 hours, the change in physical properties after that being very slight. A curve expressing the change in physical properties during the time of setting shows a very decided increase during the first 24 hours while after that time the increase is very slow.

*Initial hardening.* The initial hardening is probably due to the combination of water with the metallic phosphates formed during the mixing to form crystalline salts. You are, no doubt, familiar with the fact that copper sulphate combines with water to form the well-known blue vitriol crystals and the two reactions are analogous. The acid phosphates formed during the first part of the mix are extremely soluble in phosphoric acid and as they are converted into the very insoluble normal phosphates they combine with water and crystallize out in so dense a mass of minute, interlocked crystals that the individual crystals cannot be detected even by a high-power microscope. The formation of these ultramicroscopic crystals is favored by their crystallization from strongly concentrated solutions.

### Experiment to Illustrate the Formation of Ultra-Microscopic Crystals by the Inter-action of Concentrated Solutions.

(a) A saturated solution of sodium carbonate reacts with a saturated solution of calcium chloride to produce a gelatinous precipitate of calcium carbonate (chalk), i. e. very fine crystals.

(b) A less concentrated solution of sodium carbonate reacts with a less concentrated solution of calcium chloride to form white crystals of calcium carbonate (chalk).

The excess of powder over that required for the formation of these crystalline salts is held by the crystals just as sand and gravel are held by the cement particles in concrete.

The experiments showing the very marked effect of small quantities of water upon the rate of setting make it evident that any theory of hardening which does not explain the part taken by water in the reaction cannot be seriously considered. The water plays a most important role in the hardening and its presence must be accounted for.

The initial hardening is analogous to the setting of an oxyphosphate of zinc cement and in this respect the chemistry of the two is quite similar. It is in its secondary hardening that the silicate radically differs from the oxyphosphate.

*Secondary hardening.* The secondary hardening seems to be due to the same general causes as the setting of Portland cement. It is most probably due to the following causes:

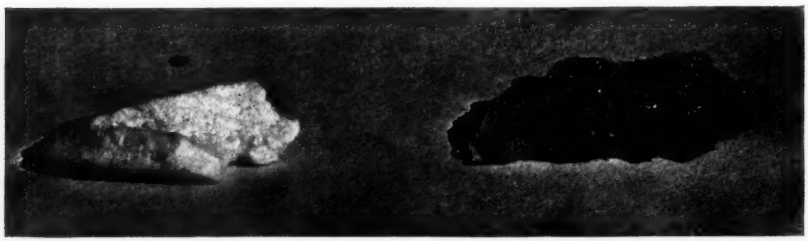
(1) The combination of water of

crystallization with calcium and aluminium silicates to form crystalline salts.

(2) The dessication of colloids. This drying out of colloids is well illustrated by the drying of glue. Both these reactions are slow and require long periods of time for their completion.

There are three practical points to be learned from this theory of setting:

1. The fact that silicates lose their translucency and show signs of cracking on the surface is due to the fact that the crystalline salts lose their water of crystallization on exposure to the air. Here is a blue vitriol crystal which has been exposed to the air. It is evident that it has undergone change on the surface for it has lost its color and is powdery. Compare it with this crystal which has been exposed to the air. Two samples of silicate, one protected from the air by water and the other not so protected, show the same phenomenon. Any form of protection from dry air such as a varnish or keeping in an atmosphere of moist air will prevent the evaporation of water from the surface of the silicate. A silicate—when hardened—is hydraulic and must remain in the presence of water in order to be at its best.



Blue Vitriol Crystal which has been exposed to the air.

Blue Vitriol Crystal which has not been exposed to the air.

2. Because of the time required for the secondary hardening any silicate filling should be left 24 hours before finishing. While a filling finished at the same sitting as its insertion may and often does prove satisfactory it *cannot* be as perfect as one finished at a subsequent sitting. No dentist would think of disturbing a concrete sidewalk in front of his house until it had hardened, so why should he interfere with the proper crystallization of a filling in a patient's tooth?

While the silicate is in the plastic state it is *not* hydraulic. This is due to the fact that the formation of the insoluble hydrated phosphates from the soluble acid phosphates requires some time for its completion. Hence in order to avoid the solvent action of moisture at this stage some precautions must be observed:

(1) The tooth should be isolated by the rubber-dam.

(2) The cavity should be dry.

These simple methods will prevent any solution of the soluble salts before they have had the time necessary to convert them into insoluble ones.

(3) Inasmuch as the silicate undergoes a secondary hardening accompanied by a marked change in physical properties, in order to obtain the best possible results the filling should be coated with a varnish or other waterproof coating which will prevent moisture from interfering with its proper crystallization.

One would not use the garden hose on a cement walk until at least 24 hours after it had been placed so why should he permit water to come in contact with

a silicate filling, the secondary hardening of which is analogous to that of Portland cement, until that filling had been allowed the same length of time for the final step in its hardening?

### Cavity Preparation.

This subject has been so fully and ably discussed by Dr. Davis and Dr. Voelker in papers already published that I shall merely refer to this topic in the briefest way:

Square margins with good retention are indicated in order to give the best opportunities for adhesion and permanence.

If the dentist who uses silicates is familiar with the physical and chemical properties of this class of filling materials the technic is extremely simple, just as the process of addition is simple provided one has learned the meaning of the figures employed in arithmetic so the proper use of a silicate attended by satisfactory results is easy so soon as the dentist understands the properties of the material itself.

To sum up briefly:

1. The presence of foreign substances of any kind whatsoever interferes with the reaction between the powder and the liquid and with the proper crystallization of the silicate. Therefore use extreme care to prevent any contamination either of the material itself or of the slab or the instruments used during the insertion of the filling.

2. The reaction between the powder and the liquid is slow. Therefore aid this reaction by thoro mixing.

3. In its plastic state the silicate is *not* hydraulic. Therefore protect it from moisture in every possible way until it has hardened.

4. The secondary hardening requires at least 24 hours. Therefore coat the filling with a waterproof varnish to keep it away from moisture and do not finish it until the 24 hours will have elapsed.

5. The silicate is hydraulic after it has hardened fully. Therefore test pellets should be kept under water-duplicating the moist environment of the filling in the mouth.

The whole law and the prophets is summed up in the single statement:

Understand the physical and chemical properties of the silicates—and then use common sense.

### Discussion.

*Dr. Frank O. Hetrick, Ottawa, Kansas:*

In opening the discussion of this paper I am going to begin at the last. I think Professor Vogt has given us a motto for the practical use of silicates, and it should be the slogan of all dentists—"Use Common Sense!"

I have been using silicate cements for many years. I have not always used them with common sense however. The manufacturers have never made some of the extravagent claims for these materials that have been stated by some of the dentists, i.e. its use for restoring contours, etc., in a successful manner.

Not a great many men in this audience are going to manufacture silicate cements, but so far as I know this is the first time the veil has been torn aside so that we, as a laity, could look in and know absolutely what we are using, know the composition of the material. It has been kept as a trade secret mostly. There are one or two instances where individuals have been told of the component parts, but we have had all sorts of trouble, with some measure of success—and why? I will not name any material, but I see some of the older men here who began with one of the first silicates. Salesmen have brought to our notice what seemed to be the ideal thing. Some have had a great measure of success with such materials, when using it with common sense. But the manufacturers did not know what the result in certain mouths might be. So we had fillings in mourning—in deep mourning, and the manufacturer said: "You do not follow

the technic that was given you,"—but, we have! And later on an improved silicate was given us, and then another, showing the manufacturer had not been sure of his ground: that it was inherent in the material that in certain mouths it would turn black. I saw a filling in a cuspid tooth that I put in that was absolutely true to color after ten or twelve years. Evidently my technic must have been a "hum dinger" in that one instance, and wrong in probably four hundred other cases! Silicate cements will not cure all the ills of dentistry at the present time. But if used with common sense they are going to do away with much unsightly dentistry. The time is here when the physician is pretty nearly going to demand you do not devitalize pulps. Dear old Ed Hunt started a movement of reform some years ago. He read a paper in Kansas on the salvation of the Dental Pulp. We had been taught to devitalize everything. Ed says, "Frank, you will live to see the day, for it is coming, when the conservation of the dental pulp will be considered of vital importance,"—and the silicate cements will go a long way in the technic of the modern dentist in the accomplishment of this result.

Use common sense! I have restored large contours in the Cental Incisors purely and simply all the way thru, of silicate cement, and some of them made me think the millenium had come and that all who did anything else were foolish, and then somebody would show me later that I was the goat again! But I never had one fail where I made a skeleton inlay to protect the incisal edge and the edges of the cavity, and some of those restorations could not be detected unless you got up close and peeked at them: some of those have been standing five or six years. Then I have noted some fillings in labial cavities that were put in three or four years ago, which were equally successful. Why? Simply because I did not follow the directions as sent out by the manufacturer. I have found I have had variable results out of the same bottle of liquid and the same bottle of powder—from the morning to the afternoon, altho the mixing was done alike, as nearly as I could accomplish it. The difference was in the temperature of the room I think. On the other hand however, I have had beautiful results when the temperature of the room was 110 degrees, and the instructions said do not mix the material at a temperature above seventy degrees. You must keep your slab cold to a certain degree and follow out a lot of very careful instructions of like character. That is a beautiful thing—to have the same temperature always, but I have had beautiful results with higher temperature also. I never have practiced slapdoodle methods, and have never stood a patient on his head to flow the material in root canals that way.

The mixing of the silicate cements should be done carefully. I do not believe the manufacturers would send out directions they believe will mislead you, and they have agreed you must mix the powder in small quantities. Dr. Vogt's paper tells you why. I never knew before. I knew this much: if the chemical reaction was to be at par, the particles of the powder and the right amount of liquid must be brought into thoro conjunction, and that is the reason I think I have sometimes had success in a variable temperature. These materials are used from South Africa to Alaska! If a certain temperature must be observed always, they must make the material for Africa, Kansas, New York, Canada and Alaska, don't you see? But temperature does play some part. So one of the safeguards against a "bad mix" is the thoro mixing of the silicate. Then, too, thoroness in preparation is essential, as Dr. Prime has said of the use of the rubber dam—he thoroly prepares the dam before he puts it on a tooth. We are generally agreed on thoro cavity preparation, but many bad results have come from trying to put fillings in without the

rubber dam, and a great many bad results from not understanding the fillings cannot be finished the same day, ordinarily.

I feel the dentist usually is very incapable of discussing the chemistry of a product, but if he has the constituent principles and knows their reaction it gives him an intelligent idea of the chemical reaction as a mechanical result. So I want to commend Dr. Vogt's paper. I have been thru Mellon Institute and others, and I know how those fellows do their work. The accuracy of their work is marvelous. Most of the world says—"I suppose!" In the South they say—"I reckon!" Dr. Vogt has not gone on record as saying that such and such is absolutely the case, but he says it is probable it is the case. A few years ago we had the man who absolutely filled every pulp canal to the apical foramen, but he has gotten under the wagon and runs along with the dog now since we have the X-Ray.

The silicate cement is a far step toward the ideal filling. It is not absolutely the ideal; perhaps we may never get the ideal filling and have a stable material, as in the metals. But it is a far step, because we have silicates now that do not discolor, and if properly mixed they are stable. I know, because I have tried them and use them constantly, and if you use common sense in the selection of the class of cases where they are indicated, you will find we have been unnecessarily mutilating the esthetic appearance of beautiful women and homely men. It is a crime with the woman, and God knows the men need all the help they can get. I have some gold crowns in my mouth because I would not have the pulps killed.

I have evidence of the wearing qualities of silicate, if properly protected.

I think this Association owes Dr. Vogt, and Mellon Institute, a vote of thanks for coming here and reading a paper that gives us fuller knowledge of silicate cements than we have heretofore had. It will make us see some of the reasons for certain of the things the manufacturers have told us about. I do not always agree with them on the thickness of the mix. If properly mixed I believe it may be stiffer than otherwise. Dr. Clyde Davis once attempted malleting them in! I do not have to pound mine in, but I do thoroly seat them. Thousands upon thousands of thousands of silicate fillings that have been failures, would have been all right had the operator waited for the secondary hardening.

*Dr. C. E. Jones, Chicago, Ill.*

I am pleased to have this opportunity of presenting a discussion upon Dr. Vogt's splendid paper. The essayist has very artfully covered up many of the technical details of the manufacture of the silicate substances; but I do not feel that he should be censured for this, because details of preparation can only be of interest to the producer—and then, many technical processes, in respect to the production of the ingredients of silicious cements, are still trade secrets.

The dental chemist has had a very difficult task in his work of preparing and combining the ingredients of silicious cements. He has been called to produce a substance dissimilar in character to any other in the cement line. He has been circumscribed to a very limited field from which to draw the elements known to possess qualities necessary to fulfill the severe requirements made by the profession on materials of this kind; and while I do not consider his work finished I cannot refrain from here emphasizing the importance of his efforts in this particular field.

The components of a silicious cement consist, in their unmixed state and as received from the manufacturer, (1) of finely ground silicates and aluminates, (2) of a liquid representing an aqueous solution of orthophosphoric acid and modifiers, in the form of aluminium, sodium or zinc phosphates. We might

sum up our present understanding of silicate powders by saying that they are a fused mass of basic oxids with silica.

In the manufacture of these silicate substances, which subsequently become the powders of the cements, a very refractive substance of almost unknown chemical composition is produced and upon which an acid of the comparative avidity of phosphoric has very little action. Therefore, it becomes necessary to include in the formula an agent that will permit of a reaction between an acid of this type and the silicate mass. Calcium is the agent used, and it is considered the controlling factor and is incorporated in excess, chemically, so as to permit of the ready action of the phosphoric acid upon it to form a crystallizing or agglomerating mass with subsequent basic hydration of the silicates by the water formed from the reaction of the acid upon the basic oxids.

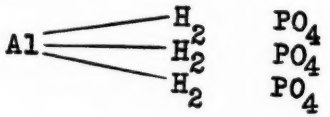
A more critical consideration of the chemical properties of these cement ingredients than is made in the foregoing will aid in substantiating some opinions now held by the writer and supported by the essayist.

The following elements were recovered in an analysis of the powder of one of the most popular of these cements of this class:

Aluminium oxid ($Al_2O_3$): silicon dioxide ($SiO_2$): calcium oxide (CaO) and phosphorous pentoxide ($P_2O_5$). They evidently had been combined at a high temperature into a liquid mass. The oxids of many of the rare earths have been incorporated in these fused silicate masses but their influence upon the real working properties of the cement are negligible. They serve to fog the formula and thus make analysis difficult.

The fusion of the separate elements is made at a much lower temperature than it would be otherwise possible by the use of phosphorous or some of the alkali metals as a flux. This fused vitreous like solution represents a true silicate, of unknown chemical composition possessing as does all silicate combinations a low co-efficient of expansion. Aluminium being out of the principal ingredients and upon which we greatly depend, along with the phosphorous, for translucency.

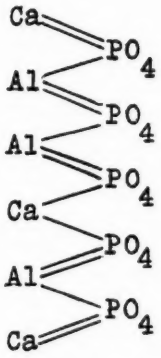
The liquid portion of the cement combination is a solution of the phosphoric acid in water modified with aluminium, sodium, zinc or silica; usually the former because of the insoluble nature of the aluminium phosphate salts. Phosphoric acid usually dissociates into the ions H and $H_2$ PO4. The ion H $PO_4$ is hardly dissociated at all when the original acid is retained in solution. Now, phosphoric acid ($H_3$ $PO_4$) gives up hydrogen very slowly and rarely ever exchanges all of its hydrogen for a metal or a basic salt of a metal when still in solution. When modified chemical properties of this acid are desired, and still all of the original physical characteristics of the thick, syrupy solution retained, the trivalent aluminium is usually added to a solution of the acid in water. The aluminium having three bonds of available chemical union attaches to the monovalent phosphoric acid by the following plan (monovalent because it nearly always dissociates in this way):




We now have after this reaction an aqueous solution of aluminium triphosphate and a residue of phosphoric acid. It would be difficult to induce greater dissociation of the hydrogen content of the trihydrated acid than is here represented, without heating the original solution (1.750 s. g.) to a point where the watery constituent would not be disturbed.

Presuming that this unstable combination exists in the liquid until brought into contact with the one energetic basic element remaining readily available for

reaction in the silicate powder, the divalent calcium, it would seem logical to believe that double salt is formed from the aqueous solution of A1 $(H_2PO)_3$ and calcium which would resemble a chemical combination with the following graphic formula:




Again, if the chemical modifications of the chemical phosphoric acid has been carried to a point where only a part of the hydrogen has been exchanged for the aluminium and the remaining chemically undisturbed acid unites with the calcium of the powder in the following manner we should expect to find any one of the following calcium salts; the primary, $Ca(H_2\ PO_4)2$; or secondary, Ca HPO4; or tertiary variety, $Ca_3$ $(PO_4)2$ in silicious cement mixes. Ostwald and others inform us that phosphoric acid dissociates into the radicals H and $H_2\ PO_4$ more frequently than into any other forms, we therefore, should expect the radical dihydrogen phosphate to combine with a divalent metal or base to form a primary phosphate $CaH_4\ (PO_4)_2$ (monocalcium tetrahydrogen diphosphate) a salt known to be very soluble. The soluble part of these cements, or that part representing a phosphate salt, or the agglomerating mass or binder is regulated by the extent of the ultimate action of the basic oxide of calcium upon the trivalent phosphoric acid $(H_3PO_4)$. To explain: If in bringing by spatulation, phosphoric acid and calcium into close relation, you promote the displacement of the hydrogen radicals remaining combined in either the aluminium dihydrogen phosphate solution or the acid solution itself there will be formed a normal, or tertiary $Ca_3$ $(PO_4)_2$ or $Ca_3\ A1_3\ (PO_4)_5$, which are insoluble salts, and the cement mass will not disintegrate; but on the other hand when you bring into contact, without thoro spatulation, either the solution of the acid or the aluminium dihydrogen phosphate and the powder a primary or more frequently a secondary salt is formed empirically represented as $CaHPO_4$ or $A1_2\ H_4\ (PO_4)_4$ which are quite soluble and which increases the instability of the agglomerating portion of the mix and the cement. The whole proposition then is one of mixing the ingredients so as to induce complete displacement of the hydrogen in the acid or acid salts of the liquid.

If the dista of Ostwald, Bloxam and others can be relied upon in respect to the way in which phosphoric acid dissociates, we can hardly hope to have any other than a double salt formed when modifiers such as aluminium are added to the acid solution. This double salt formation is a very desirable one because it increases the translucency of the finished mixes—this is due to the extreme translucency of the aluminium salts, which also increase the insolubility of the set cement. Silicate powders too rich in calcium cement are likely to be very opaque owing to the fact that salts of calcium possess considerable refractive properties to light.

The essayist's plan of modifying the phosphoric acid with oxids of metals, with the subsequent water formation, is not in my opinion the best plan. I would rather induce hydrogen displacement in the acid by using a pure metal thus overcoming the likelihood of too free ionization and dissociations beyond the primary stage of salt formation.

While a combination of calcium and

the group $PO_4$ in any one of the three possible salt forms may be quite insoluble, it is well known that the normal salt $Ca_3 (PO_4)_2$ is least soluble of any. It therefore seems quite obvious that whenever possible this tertiary or normal salt should be formed, as has been previously stated in this discussion. Orthophosphoric Acid ($H_3PO_4$) dissociates first into the ions H and $H_2$ PO4. The divalent calcium element would, if brought into contact with but two molecules of the phosphoric acid, form Ca $(H_2PO_4)_2$ a primary or more soluble salt than normal calcium phosphate.

It thus will be seen that the agglomerating mass, or that portion of the cement mix binding the mixture together, is most likely to be composed of a soluble salt, that is, when no effort has been made to induce further dissociation than the primary stage of salt formation. If it were permissible to use the physical factor that causes easy and rapid chemical exchanges of elements namely heat, we would get almost complete hydrogen displacement in our solutions of acids and salts; but we cannot utilize this enhancer of chemical action since it would cause too rapid setting, for practical purposes, of the cement.

Since it is our desire to increase the permanency of these silicious mixes, when they are used as restorations of tooth structure it might be well for us to here consider by what means this increased permanency may be brought about.

Normal phosphates whether they contain or have one or more metallic radicals are practically insoluble in water. It is therefore obvious that the normal phosphate salts are the ones most desired. Let us look then for some method or way of transforming these soluble salts, primary and secondary calcium and aluminium phosphates into the more insoluble normal phosphates. *It is known that insoluble calcium phosphate can be formed when it is mixed with a soluble calcium phosphate in solution.* If this known reaction can be depended upon to take place, that is, with the procedures we expect to put in operation in the mixing of our cements, I am of the belief that we can nearly always make an insoluble agglomerating mass by thoro and prolonged SPATULATION out of the product first formed when the phosphoric acid or modified solution and basic calcium oxid are brought together. The process of spatulation, acting as a mechanical means of bringing those portions of the powdered combinations containing the divalent calcium and the liquids containing the aluminium and dihydrogen phosphate into a sufficiently close physical relationship to promote further dissociation of all the hydrogen atoms still remaining attached in the primary or even secondary salt formations.

It is our desire to have these normal phosphates formed, because of their comparative insolubility. Realizing that the heavy syrupy liquids, because of their low water content (in proportion to their dissolved ingredients) possess very little dissociating power and thus fail to act as suitable vehicles for carrying the basic calcium oxid in contact with the acid and modified solution of the acid, I am led to suggest making the mixes upon a slab approximating 65° F. in temperature, bringing the powdered silicates in small portions into contact with the liquid with the aim of producing a normal salt, by displacing the hydrogen ions of the phosphoric acid and solution of aluminium hydrogen phosphate with calcium, depending upon spatulation to dissociate the radicals instead of permitting a slower and not so complete reaction when little or no spatulation is used, and which invariably results in the formation of a soluble acid salt. We thus would expect the mechanical procedure of spatulation to serve as would a liquid having high dissociating properties, by increas-

ing the encounters between the molecules of the reacting agents.

In order to impress you with the necessity of doing this operation of spatulation as suggested, I wish to here state that polybasic acids of the variety used in cement making are dissociated slowly and that each successive displacement of the combining weight of the hydrogen is done so with increasing difficulty. To illustrate this point: The first hydrogen atom displaced in the reaction between the phosphoric acid and the basic ingredients of the silicate powder is produced with comparative ease and rapidity—Ca $(H_2 PO_4)2$ or $Al_2$ Ca$(H PO_4)4$ being the product—but when further dissociation is attempted a more difficult task is met with, owing to the tendency of the divalent combination $H_2$ PO4 to remain closely united and difficult to dissociate at cement mixing temperatures. One might when hastily observing the possible reactions referred to in this discussion believe that the chemically active calcium would rapidly displace all of the hydrogen of the phosphoric acid or its modified solution; and thus form a normal salt; but a closer inspection will at once show that any reaction between the two substances would be greatly retarded by the chemical slowness of the acid and by the nature or way in which the calcium is held in combination as a silicate in the powder. This chemical peculiarity of the $H_2PO_4$ along with the tendency of the silicate combination to give up its calcium content slowly will help to explain why in hastily made mixes there is formed invariably a primary or soluble salt of calcium. One or even both of the atoms of the hydrogen remaining in the monocalcium dihydrogen phosphate may be displaced when this product is in solution, and a secondary or tertiary salt of calcium formed by further spatulation or agitation, thus bringing the basic calcium in contact with the divalent hydrogen phosphate ion while the liquid of the mix is still able to act as a vehicle in carrying the elements into sufficiently close chemical relation to permit of an exchange of their radicals. The truth of this has been satisfactorily demonstrated by testing the character of the salts, formed by various ways of spatulation and recovered from cements that had been mixed and permitted to set for various lengths of time.

For the sake of describing the process by which an insoluble salt may be formed in our cement mixes and in hopes that you may have a better understanding of just what is meant when we suggest prolonged spatulation in the early part of the cement mixes, the following is offered: I believe it is customary to introduce the correct amount of powder into a mix of a two drop size in at least five or six divisions until we have produced a putty-like consistency, advised by the manufacturer. The procedure about to be suggested is no different from that already well known to you, except that it is advised that comparatively small portions of the powder be drawn into the liquid during the early stages of the mixing process. If you are in the habit of drawing a considerable quantity of powder into the liquid in the very first stages portions of the mix, I would suggest that you divide that portion usually made for the first incorporation in a two drop mix, into at least three portions. The powder being light in weight and fluffy is readily absorbed by the liquid, thus during the process of spatulations the three or more small divisions of the powder are readily taken up and the mix remains in a semi-liquid state. We continue to add small additions of the powder with considerable spatulation until the powder begins to assume a heavy creamy consistency and that extreme glaze or gloss that was noticed over the surface of the mix is practically lost, owing to a partial or total neutralization of the phosphoric acid.

The difference between the plan now generally followed and the one suggested in the discussion for mixing these

cements, refers only to that part of the process indulged in early in the mixing period. The portions of the silicate powder added late to the mix, in order to obtain physical consistency, are made in the usual manner. It is only during the early mixing of the cement ingredients and before one or more combining weights of the hydrogen of the acid or the solution of the aluminium dihydrogen phosphate have been dissociated, that we can hope to cause the chemical change, by which an insoluble agglomerating mass is formed. It is true that prolonged spatulation will retard the setting properties of the finished mix, first, by inducing a loss of heat, formed thru chemical reaction, by radiation into the air and mixing slab, and secondly, by disturbance of the process of crystallization manifested during the initial or early period of the chemically combining of the cement elements. But tests have proved that the retardation induced in mechanically disturbing the reacting agents is of no appreciable length of time. It will be observed that prolonged spatulation, provided the reaction leads up to the formation of a normal calcium or aluminium phosphate, will induce complete neutralization of the acid content of the liquids—thus obviating irritations due to still active portions of the acid, likely to be contained in the mix after its insertion into the tooth cavity.

While the silicious mix may set slower than otherwise, owing to the loss of heat during spatulation, and to the prevention of any gross chemical reaction after the material has been inserted in the tooth, I do not believe nor does any test I have been able to use in my experimenting, cause me to suspect that the filling becomes more susceptible to the disturbing action of extraneous water, contained in saliva, and which may come in contact with the unset mass. On the contrary I am led to believe that the silicious mass is less subject to the deleterious action of the water content of saliva than when hastily mixed and inserted while chemical changes are still active between the acid and basic oxids. This increased resistance to the injurious action of saliva might be explained by stating that by thoro spatulation a sufficient amount of water is formed as a product of the reaction of the acid upon the basic oxide to permit of a proper balance of the water of constitution in the crystallizing mass, with subsequent hydration of the silicates as explained in another part of this discussion.

It is to this feature of our procedure in the preparation of these cements, that I wish to particularly call your attention, believing as I do that it is possible to most always produce a normal phosphate by thoroly spatulating those small portions of powder first brought into the mix.

The mixing slab should be thick glass with etched surface, absolutely clean and free from deep scratches. The spatula should best be agate, and one with a sufficiently long working blade to reach nearly across the slab; it should also be thin enough to permit of transmitting a sense of feel at its working portion. The number of instruments for inserting the material should be ample and of suitable shapes and sizes; they may be of bone, agate, ivory, tantalum or any similar material. Steel should never be used for reasons you well know. If a silicate is to be used, that is known to have an energetic liquid or powder, or both, it will be well to cool the slab to as low a degree of temperature as atmospheric conditions will permit. The cold mixing slab becomes a necessity in the working of those cements that heat quickly following chemical reaction between the liquid and powder. The reduction of temperature may be appreciated when you are reminded of the fact that a rise of ten degrees F. in the temperature of the slab and cement ingredients thereon situated will increase the avidity of the acid 100%. It is also known that a retarded chemical reaction

in the mix will permit of greater incorporation of the cement powder. This may work a decided advantage in those cases where translucency is not desired, since a greater portion of the insoluble ingredients may be brought into the mix.

We are assuming that previous to making the mix you have arranged your instruments and accessories, such as matrices, etc. The colored variety of matrix serves best. Lavolin, vaseline or any unctuous or oily substance may be used for the purpose of preventing adhesions of the cement to the surface of the matrix. Personally I like to use liquid Lavolin. The matrix should be so attached that it will represent a rigid wall, against which to confine the plastic material. Pulps should be protected in deep seated cavities by placing non-conductive agents between pulps and the silicious filling material. Pulps occasionally die under silicious cements which I think due to the encroachment upon pulp chambers without making any exposure of the pulp as we would likely do in cavity preparation for gold filling, and not to any irritating action of the cement itself.

The mix should be stiff enough in all instances, to permit of forcible packing. The angles and undercuts should be first filled, followed by the insertion of a sufficient quantity of cement to force that portion first placed laterally against the walls of the cavity and into definite position.

When the cavity has been filled to excess the matrix may be brought into final position and the filling compressed and retained until a partial set, at least, has been secured. One important thing in connection with the use of the matrix is to always keep the filling material and matrix undisturbed until a firm set has taken place. This means that the matrix should be well secured in position before beginning the insertion of the cement. I am quite sure that insecure and early removals of the matrix cause more failures than any other of our faulty manipulations of this material.

After waiting at least ten minutes for the cement to partially crystallize the dam may be removed and the filling finished, with due regard to a desire to place all surfaces in a polished condition. This may be done with fine cuttle fish discs, or strips that have had incorporated in the grit, paraffin or some similar lubricant.

Wear by attrition seems to be the most frequent change occurring in cements of the variety under discussion, and since there is a possibility of minimizing the amount of loss in this respect, it might be well for us to here state that the higher the polish, the less surface there will be exposed to attritional forces and the more lasting and durable will be the finished product.

A rough or irregular filling presents immeasurably more surface to frictional and dissolving action than does the filling with smooth surfaces. The celluloid matrix seems to put an ideal finish on these fillings. On the occlusal surface a very thin piece of celluloid may be held in position and the filling burnished under it, spreading always with a burnishing-like motion toward the cavity margins. I have made sufficient experiments to at once determine in my mind that a filling which is kept well polished will outlast the unpolished one.

I know of nothing that the operator can do in working these cements that will so increase their durability as will a high polish. High polish, in this respect, means a series of fine scratches running in the same direction.

I have observed some disappointing results due to the subsequent discolorations of tooth structure and cement that one occasionally finds after the filling has been inserted for some time. These discolorations will show only after the cement has hydrated sufficiently to become translucent. These dark areas are

usually due to the discolored dentin left in the tooth structure before the insertion of the filling. There are two very good ways of determining when slightly discolored dentin remains. One is to dry the cavity with alcohol and whenever there is a discoloration it will quickly show: another is to transilluminate the cavity and tooth, the discolored parts will show as the light shines thru the tooth structure. Discolored dentin spoils much of the esthetic effects of our silicious cement work. Another place where frequent failure is noticed is where these fillings are made, in their contour, to restore the contact point. The patient will return in a short time complaining of discomfort because of food packing beyond this point due to the wear by attritional action of the teeth and subsequent dissolving by the saliva of this part of the filling. In order to over-come this difficulty, I have embedded at this point a little round rod of porcelain with an exposed oval end, which establishes an indestructible and permanent contact point.

I have found it difficult to epitomize my remarks covering that portion of my discussion devoted to the proper mixing of these cements. It was not my intention to lead you into a maze of chemical lore, but Dr. Vogt's able effort evidenced by this contribution to our literature has quietly but favorably enticed me into a prolix state.

I most heartily compliment the essayist on his splendid paper.

*Dr. Clyde Davis, Lincoln, Neb.*

We have listened with much interest to the paper of Dr. Vogt on "The Chemistry of the Silicates," as it has made *clear* some of the questions regarding this valuable class of filling material.

We find little in the paper about which there can be any question, hence this discussion must partake of addition rather than subtraction.

The work which the writer has done has dealt mostly with the physical properties of the silicates rather than their content.

Not that of which they were made, but that which they make.

Not how to manufacture, but how to manipulate.

It, therefore, follows that this study of the essayist puts just a little stronger foundation under our findings as to the best method of manipulation in obtaining the greatest resistance to the crushing strain and dissolution of the oral fluids.

It is quite true that the best fillings produced from silicate, are far from perfect from a *theoretical* standpoint, which is equally true of all other materials used.

*Practically,* the silicates must be regarded as a success at this time, and their further development depends upon the labors of such scientists as Dr. Vogt and others to further perfect the formulae, looking to the betterment of the physical properties and simplification of methods of manipulation.

It is then up to the members of the Dental professsion to master the technic that ideal results may be obtained.

THORO MIXING.

The essayist brings out one point we desire to emphasize and that is, the production of the maximum amount of the acid phosphates by thoro mixing. To this end the period of first reaction should be made as long as possible, which we think can best be accomplished by a low temperature mix, to be found about 60 degrees F.

The lower temperature retards chemical action, staying off the adhesive and cementing qualities giving the manipulator more time for thoro mixing. We are fully aware that this lower temperature also retards the formation of the desired normal phosphates, but the primary problem is one of mechanics; that

of getting every granule of the power bathed with the liquid on all surfaces.

It therefore follows that the finer the grind the greater the mechanical problem, and the necessity of thoro mixing before reaction takes place.

The essayist illustrates his point by calling attention to the fact that "A powder made by crushing and grinding a hardened pellet will react with the silicate liquid producing a coherant mass showing that not all the grains of powder have been completely acted upon in the first mix." In further proof of this, we wish to state that when these pellets are made of a coarsely ground powder the reaction in the second mix is greater, showing that it was less in the primary mix which augurs for finely ground powders.

Again when the primary mix is made most second grinding shows a lower temperature the resulting pellet made from second grinding shows a decreased resistance to the crushing strain, suggesting that the first mix was productive of a greater amount of the normal phosphates, hence more complete cementation.

That part of Dr. Vogt's paper which deals with the secondary hardening of silicate is most interesting particularly the second cause, namely the dessication of colloids. The colloids are most widely distributed in nature, being even in the air we breath without which light is not transmitted, hence their presence in silicate is a foregone conclusion, but that the silicates in this point resemble Portland cement is new to us, yet most plausible. We would like to ask the essayist if it may not be possible to increase the colloid content of either the powder of liquid thereby, lessening or stopping altogether the loss of the water of crystallization from the crystalline salts, thus giving us a silicate that may be exposed to the air without deteriation? A good Chemist asked us that and he did not look foolish. We could not answer the question, hence pass it on.

FINISHING.

The essayist says "Any finishing should be left 24 hours before finishing" and sights the technic of building a sidewalk to illustrate his point. Now if Dr. Vogt means literally all finishing, we must disagree with him.

We maintain that the finishing must be divided into three operations.

1st. Before primary setting the surface should be rendered reasonably smooth.

2nd. Just following primary setting the excess overlapping margins should be broken away while it can be done without much resistance, as in Portland cement work.

3rd. After 24 hours, as he states, polishing may be resorted to. However, we prefer to finish with the knife, file and keen edged chisels, as that finish takes on stain equal to the enamel and the better esthetic effect results.

The essayist calls attention to the fact that silicate is *not* hydraulic until primary setting is complete. The disregard of this fact on the part of many operators is the cause for many failures. Fillings are put in where moisture is not absolutely excluded, especially at the gingival margin. Again care is not taken that the varnish is made to completely cover the filling in the proximal space as well as contact point in proximal fillings.

The physical properties of the silicates are most interesting.

The writer has had a machine made to test the resistance to the crushing strain as well as the flow of metals under stress.

The various methods of manipulation have been compared. Also the product of individual manipulators, in the various makes to be found on the market.

We here give some deductions and conclusions, omitting to name any manufactures material.

In the work, instructions as to manipulation, were followed as well as varied.

All samples for testing were made into cylinders 5 millimeters by 5 millimeters and then protected in the machine with a thin sheet of fiber bushing.

CONCLUSIONS.

Increased strength is produced by:

1. Thoro mixing.

2. Starting the mix at a temperature of about 60 F and raising to 65 or 70 degrees by the time the mix is completed.

3. Age, without limit, provided the air is kept from the produced filling.

4. Homogenious mass when completed.

As to the pounds stress a cylinder 5mmX5mm will stand the writer has been unable to verify some of the published reports of the works of others. The highest resistance of any single cylinder we have tested was made by Dr. Vogt, and sent to us with nine others all prepared in the Mellon Institute. This single specimen crushed at 788 pounds.

In June 1916, Dr. Arthur D. Black, kindly offered us the use of the laboratory and instruments of his father, the late Dr. G. V. Black, to assist in this work.

Four makes of material were used.

Ten cylinders of each mixed at 65 F. 28 days old.

Manufacturers instructions as to manipulation followed as closely as possible:

Material "A" averaged 256 lbs.

Material "B" averaged 233 lbs.

Material "C" averaged 265 lbs.

Material "D" averaged 254 lbs.

The lowest record made at this time with any single specimen was 150 lbs.

So much as to the result of our work in 1916.

During the past year there has either been some change in the formulae or else we are getting more proficient in the manipulation as we have been able to get averages above 500 pounds with two of the products on the market.

In considering these figures please remember that few human jaws can be closed with a stress of 200 pounds and that, upon cushioned surfaces.

Again, a 22k gold casting the same size, 5mmX5mm, showed one point of flow, in one minute under 300 pounds stress. Silicate as now constructed is certainly ample for the force of mastication, provided it has sufficient bulk.

In making these cylinders we discovered the difficulty of eliminating comparatively large air spaces in the body of the cylinders, something to be guarded against in practical work.

This material has come to stay and the improvements of the future must surely make it worth our while.

GENERAL DISCUSSION OF DR. VOGT'S PAPER.

*D. A. Zurbrigg*, Philadelphia, discussing Dr. Vogt's paper: I would like to compliment Dr. Vogt on his paper, the fidelity with which he explained the different processes and the trouble he took to give these experiments here. I would congratulate him, also, on taking advantage of all the published literature on the subject that has gone before, particularly that given out by the scientific departments of reputed commercial firms. I am sorry I cannot say the same of our friend, Dr. Hetrick, for in April, 1916, in the *"Journal of Industrial and Engineering Chemistry,"* was given not only the ingredients of silicate cements, but of the zinc and copper cements, together with charts and tables explaining many of the questions which have come up here today.

I would like to ask Dr. Vogt how he explains adhesion in any dental cement, meaning adhesion in the "set" condition. We all understand the stringiness of a thinly mixed or a plastic mixed cement, but not of a cement—either zinc, copper or silicate in a set condition, on a smooth polished surface. I am elimi-

nating the prepared cavity which has not a smooth, polished surface.

May I ask Dr. Davis, in the tests he made, did he take account of temperature which has a strong bearing on the crushing strength?

*Dr. Davis,* responding to Dr. Zurbrigg—Dr. Vogt's Paper: Maybe I did not make it clear. The temperature used was 65 degrees F.

*Dr. Zurbrigg,* addressing Dr. Davis—Dr. Vogt's Paper: I understood you to say you mixed at 60 degrees, ending at 65 degrees.

*Dr. Clyde Davis,* responding to Dr. Zurbrigg—Dr. Vogt's Paper: A temperature of 65 degrees at the start is raised to possibly 68 degrees before placing in capsules. I had work enough for two days in the laboratory and had mixed and marked the tubes and worked on all I mixed in one day and the next day waited for the next and think none were older than 28 days.

*Dr. Zurbrigg,* responding to Dr. Davis—Dr. Vogt's Paper: Did you test in saliva or in water?

*Dr. Davis,* responding to Dr. Zurbrigg—Dr. Vogt's Paper: Always in water. I placed them all in a water bath.

*W. V. B. Ames*: I want to commend Dr. Vogt in that he has brought this subject before us, classifying the silicious, or silicate, cements, or whatever they might be called, as Oxyphosphates. I think this subject has been seriously befogged by the names given these materials and the attempt to give the idea that they are distinctly different in their chemistry from the oxyphosphates we have been using. Up to the point of the secondary setting of these cements, we have an oxyphosphate cement, pure and simple, governed by the laws governing any other oxyphosphate we have been using, so if you go home after this discussion of this subject, with the idea of handling these oxyphosphates as such, you are so much ahead.

A previous speaker suggested that considerable information has been given in the Journal of Industrial Chemistry, as to the composition of these materials. I am a bit touchy over the statement that today has seen the first disclosure of the nature of these silicious oxyphosphates. At odd times during several years past, I have told what has been told today and have said that whether the material is called "Artificial Enamel," "Synthetic Cement" or by any other name than one which would indicate an oxyphosphate, the subject has been befogged and if we treat it as an oxyphosphate in which the reaction depends on ordinary chemical tendencies, we come nearer an understanding of the subject.

Dr. Hetrick said that sometimes he would get a beautiful mix and sometimes something entirely different, and he thought it due probably to atmospheric temperature. I think it was more the temperature of the slab, which Dr. Davis has brought to your attention and with which you probably all are familiar. All you need to do is stop and think what you do in other processes.

For quick results, you pickle gold in warm sulphuric acid—you do not use it cold. You know Portland Cement will set much more quickly on a warm day than on a cold one. You may bring this knowledge to the making of these mixtures and secure uniform behavior by uniform temperature of slab.

I cannot quite reconcile myself to pass over the alleged fact that unlimited mixing and spatulation is necessary in these materials. The actual setting depends on basic phosphate and by overspatulating you head off the proper formation of the basic phosphate. You can, with the oxyphosphate of zinc to a marked extent, and to any of the cements to an extent, kill the setting by indefinite spatulation.

I want to go on record to say there is

a limit to the desired spatulation to be indulged in. You can get a quick, granular result from too rapid incorporation of powder: you can modify it with a reasonable spatulation, and can kill the result by over-spatulation.

If I had time, I would disagree with Dr. Jones on the necessity of a matrix. I believe these materials should be used with an excess of material, and have something left to trim down. I think Dr. Davis had this in mind in outlining his procedure. I think we get a better surface by having excess at all points and I do not place as much importance as some others on the strip or band matrix. The faulty crystallization will appear on the surface, and if you trim all exposed surfaces you will get a surface which is comparatively free from imperfections and you are often better off than if you used a matrix.

*Dr. Vogt*: Regarding the question of Dr. Hetrick, as to varying results from morning to afternoon, I have the same opinion, that it was probably due to a change in temperature. At one time the temperature was all right and at another time it was not, as Dr. Ames pointed out. Chemical reaction depends on the temperature at which the reaction takes place. Roughly speaking, a chemical reaction doubles its speed for each rise in temperature of about 20 degrees F. So you would expect one and one-half to two times as rapid a reaction.

As to Dr. Davis's question, I do not think the percentage of colloids has much to do with it, since it is more a question of the quantity of water vapor in the air. If you put a crystal of glauber's salt in the air and let it stand, it will crumble down, due to the fact it has given up water. So the silicate cement will lose water on exposure to the air. If you can change around the atmosphere so the vapor pressure of water in the air is a trifle higher, you will not have that trouble with the silicates. I am afraid you will have to get along with those that do dehydrate when exposed to the air.

I stand corrected as to the word "finishing" where I meant "polishing." I should have said "it should be polished the next day" and not "finished."

As to adhesion to smooth surfaces. I do not think any dental cement, or glue or anything else will adhere to an absolutely smooth surface, after it has hardened or dried out. I worked two or three years next to the laboratory of a man working on glue. He dried glue on glass plates and then picked it off the glass plates after it was dried. The question of whether or not a thing is adhesive in a hardened state has nothing to do with this matter. My opinion of adhesiveness in a cement is that by the adhesiveness the thing possesses it makes a better joint, as when you take two pieces of board and nail them together and they then stick fairly well, but they stick better if you both glue and nail them, since the glue slips into the particles of the wood and it is mechanically interlocked there. The fact that a dental cement, when hardened, or glue or other adhesive after it has dried does not happen to stick to a smooth surface, has not a lot to do with the question.

*Dr. Zurbrigg*: Why use the term "adhesive," then?

*Dr. Vogt*: Because while in a moist condition it is sticky or adhesive and you get a better joint because it has penetrated into these various little particles and holds there.

*Dr. Zurbrigg*: It is physical adhesion. Is it inherent in the cement itself?

*Dr. Vogt*: It is no longer adhesive after it is hardened. I think the idea of adhesion in cements is simply that because of the adhesive qualities while plastic you get a better joint, just as in the case of putting two pieces of board together. Because the glue you use happens to be adhesive, the thing holds to-

gether better. In a plastic condition, glue is adhesive and in a dry condition it is not. I think the point is you simply get a tighter join—i. e., a more perfect adaptation, that is all.

*Dr. Prime*: You get a physico-chemical locking there.

*Dr. Vogt*: Yes. The strongest glue is the very thinnest film you can get there.

*A Member*: You get almost a vacuum by taking away the air pressure.

*Dr. Vogt*: Very probably.

Regarding the theory of hardening, I still must adhere to the idea that the hardening of the cement is due to the hydration of a salt rather than to the formation of a basic salt. It is a pretty hard thing on the supposition of the formation of a basic salt to explain why it is that a very small change in the concentration of water will produce such a marked change in the rate of the setting of the cement. It may very well be the hydration of either a basic or a normal salt, but water certainly takes some part in the reaction. In addition, the fact that a pellet of cement when left in the air simply loses water and nothing else, and crumbles on the surface, points in absolutely the same direction.

I do not think you can cite an instance of a basic salt losing water and crumbling on exposure to the air, while any number of cases of this phenomenon may be given with crystalline salts.

Until we can hear of definite cases of basic salts exposed to the air, and then crumbling, I am afraid I shall have to stick by the hydration theory.

# AFTER-PAIN AND ITS RELATION TO GENERAL AND LOCAL ANESTHESIA FOLLOWING OPERATIONS ON THE MOUTH.

By Arthur E. Hertzler, A. M., M. D., Ph. D., F. A. C. S.

(Read before the National Dental Association at Its Twenty-First Annual Session, New York City, N. Y., October 23-26, 1917.)

WE MAY define after-pain as the sum total of unpleasant sensations an individual experiences as an immediate direct result of a surgical operation. These sensations may be due to the direct injury to tissue, or to phenomena incident to their repain, or to disturbance of functions caused by the necessary steps of the operation. When viewed in this broad way the problem becomes a very complex one. This is particularly true in operations about the mouth and jaws. The reason for this is that wounds of the oral cavity nearly always suffer complications from infection and the region they occupy must be traversed by all the elements that go to sustain life and therefore cannot be for long set out of function.

We may separate our problem into three specific phases and a general one. In the first place pain results from the severance of tissue. In the second place in our efforts to restore the continuity of tissue we compress the tissue by means of sutures and in order to check hemorrhage ligatures are used. In the third place there may be reaction in the tissue from infection about the wound that adds materially to the suffering of the patient. These first two are fixed factors and their extent can be accurately measured when we determine the nature and extent of our operation. The third group includes the secondary factors which are more variable, being due to the character and extent of infection, but they are present to some extent in nearly all operative wounds about the mouth. A fourth group must be recognized which includes the more general factors such as headaches, pain on deglutition, nausea and general constitutional disturbances. The extent and character of the operation and the individual disposition of the patient make this group a very variable one.

These four sources of after-pain require detailed consideration, for, in order to lessen the suffering of the patient as much as possible, it is necessary to accord to each of them a full measure of attention.

I. *Pain Produced by the Severance of Tissue.* When a nerve-bearing tissue is severed a burning pain follows, usually lasting two or three hours. This is most pronounced in tissue which possesses a large number of nerve terminals. The tissues about the mouth are not the most sensitive in the body, fortunately, for their character is such that skill in making the incision counts for little. Large nerve trunks, of course, such as the branches of the trigeminus, hypoglossal, and pharyngeal may usually be avoided. Where the mucous membrane is attached to the bone the nerve supply is such that there is no choice in the site of the incision.

The pain produced by the cutting of the tissue is the least important of the causes of after-pain. A momentary, in-

tense pain is caused and a burning sensation of brief duration remains, usually lasting together not more than a few minutes, a period easily covered by the duration of any of the anesthetics commonly used. The little accidents incident to shaving give frequent opportunities for the study of this factor in miniature.

II. *Pain from Ligation and Suture.* Vastly more important than the preceding is the production of pain by constriction of tissue by sutures or ligatures. The burning pain experienced in freshly made operative wounds, usually ascribed to the severing of the tissue itself, is in fact due to the ligatures and sutures employed. Any one doubting this statement may be convinced by placing two wounds somewhere in connection with his sensory centers, one with sutures and one without. The duration of constriction pains, either from sutures or from ligatures, may be placed at from a few hours to several days depending on the situation and tightness of the ligature.

Theoretically, therefore, in placing ligatures, nerves should not be included in the constriction of the blood-vessels. In most situations the large nerve trunks can be avoided by isolating the vessels from the surrounding tissue, but most vessels have filaments running in their sheaths which cannot be avoided. The incision should be so placed, therefore, that the minimum number of ligatures will be required. This applies particularly to the lip and tongue. Hemorrhage from bone is controlled by wax or a plug, neither of which add to the after-pain.

In many regions of the oral cavity the vessels run in tissue too dense to admit of isolation of the vessels. This is particularly true of the gums and hard palate. In this situation mass ligation, compression by packs, styptics or the cautery must be relied upon to control hemorrhage. Because of the close adhesion of the soft tissues to the subjacent bone mass-ligation is not feasible. Styptics are inefficient and tend to insure the soft parts. Except for very small wounds this means for the control of hemorrhage is not applicable. There remains but the pack and the cautery. The pack is used to control bleeding caused by incision by sharp instruments. The cautery serves both as knife and hemostatic. Each of these have their place. For surfaces which produce a diffuse oozing the cautery is preferable. Where large vessels are severed, which cannot be controlled by ligature or plugs, packing may be the most readily available means.

Each of these measures produce pain. The cautery produces a stinging pain lasting several hours or more. Relatively low temperatures acting for a prolonged period produce pain lasting for a longer period than a high heat acting for a briefer time, but the latter acts badly as a hemostatic in proportion to the degree of heat and the brevity of its action. The pack causes pain by pressure not only on the oozing area but on surrounding tissue as well. The pack, therefore, should be placed so as to press as little as possible on regions other than the bleeding area.

The suture of the severed tissue presents a more easily solved problem. All that is required of a suture is that the edges of the wound be held in apposition. Fortunately the sustentacular tissues of the body are little sensitive. Bone deprived of its periosteum, and fascial planes, deprived of the nerve-bearing areolar tissue which covers them, are not painful when sutured. The general reconstruction of anatomic relations disturbed by the operation must, therefore, be brought about by the suture of these tissues.

When the deeper structures are so managed, the skin, if the line of incision has been properly placed, all but falls together without the agency of any mechanical aid. Any pressure beyond that required to hold the skin in apposition

is cruel and baneful. All that is required at most is a fine suture drawn taut enough to hold the severed edges in gentle apposition.

When much muscle or fat has been severed deep sutures may be placed in order to avoid the formation of dead spaces. These should be drawn only so tight as to bring the parts together, for muscle tissue is well supplied by nerves and causes pain when constricted.

III. *Pain due to Wound Reaction.* Under this head we may consider those painful sensations which are incident to reaction of the tissue itself in the region of the operation. Most wounds produced by the surgeon heal without notable reaction but in operations about the mouth practically all wounds become infected. It is this response of the tissues to infection that gives rise to most of the pain to which the patient who has undergone an intra-oral operation has to endure.

Since infection cannot be prevented our endeavors must be exercised toward limiting it. Since the operation is always done in a field covered with bacteria the problem is to prevent their entrance into the tissue spaces. The chief means of attaining this end is to operate with the electric knife. This method has the virtue of destroying the bacteria in immediate contact and of providing an aseptic charcoal dressing for the newly made wound. Unfortunately this eschar acts in a measure as an irritant and such wounds cause pain for a considerable number of hours. When heat is applied for a long period at a low heat, as is usually employed in the treatment of malignant tumors, the tissues are injured for a considerable distance beneath the surface and pain resulting from the reaction against this eschar may last for days. It reaches its height soon and gradually disappears differing in this from infections which are apt progressively to increase for indefinite periods. Wounds so made always require some weeks for healing and the method is therefore unsuitable for use in tissues capable of more rapid union, as in operations on the lips and tongue. For the destruction of lesions of the gums and hard palate it may be advantageously employed.

In many regions where ligatures cannot be placed for the control of bleeding gauze packs must be resorted to to control hemorrhage. They serve at the same time to close the tissue spaces against infection and to provide drainage. When used for the purpose of limiting infection gauze, impregnated with some powdered antiseptic, is the most efficacious. Gauze so placed excites a reaction in the tissues and the production of fibrin resulting anchors the pack in place which may serve as a relatively aseptic dressing. When extensive infection does not take place it may be allowed to remain a week or more. Usually, however, active suppuration takes place about the pack and it then acts as a foreign body and greatly increases the pain. In the use of packs, therefore, care must be taken lest an unnecessary amount of after-pain be produced by its presence. In all cases save about the floor of the mouth and larynx packs rarely can be left more than a day without adding unnecessarily to the suffering of the patient.

Secretions which may be retained in a wound may, by increasing pressure, cause great pain. We may circumvent the pain by providing free drainage. Gauze is commonly used for this purpose. If when soft parts are brought in apposition by the suture ample drainage is left between the sutures at some convenient point, gauze drains may early be dispensed with. The old fallacy that drainage must be provided at the most dependent part of the wound may, however, be disregarded. The argument that a jug will empty only when the neck is held dependent is true only of jugs and other receptacles with rigid walls. Soft tissues tend to fall into apposition and force the fluid out no matter where

the opening may be, just as the small boy's football deflates itself no matter where the puncture may be. This fact is important about the mouth where the placing of a drain at the most dependent part would involve sensitive structures and often add greatly to the resulting scar. For instance, operations on the upper jaw involving the soft parts can always be drained intra-orally, thus avoiding the pain which would be caused if the drain extended thru the skin surface. The same is true in operations on the lower jaw and floor of the mouth. If the wound is kept open the wound secretions will find their way into the mouth, thus avoiding a drain and the resulting scar.

IV. *Pain due to Secondary Factors.* Under this head may be included those painful sensations which are foreign to the wound and its repair. Among the more remote causes of discomfort are such factors as headache, disturbances of the wound in the act of vomiting or coughing, or even respiration and deglutition. Headache is nearly always present to some degree. Applications of cold is more apt to give relief than is the use of heat. The use of one of the coal tar products often mitigates the suffering.

Swallowing is painful if the organs of deglutition are injured in the operation or the coincident reaction involves them. When pain from this source is great fluids may be introduced per rectum in order to allay thirst. This makes the need for swallowing less urgent. In some instances the stomach tube or large catheter may be slipped into the esophagus and gravity is allowed to take over the labors of the constrictors of the pharynx. By use of such means complete rest can be secured for the wounded area for a prolonged period.

Vomiting is usually due to the anesthetic and may be in a measure at least, controlled by the choice and method of administration of the analgesic.

Coughing is dependent on tracheal irritation and may be largely controlled by preventing the entrance of any irritating substance into the respiratory passages. The substances which produce the irritation are chiefly the anesthetic and blood and secretions from the field of operation. Inhalation anesthesia is responsible for much of the tracheal irritation and for the entrance of the extraneous products that flow into it during the operation and during the post operative period before the respiratory reflexes return. Intra-tracheal anesthesia enhances the first but largely eliminates the latter. All suffering due to irritation of the trachea are eliminated only by the use of local anesthesia.

Interference with the respiratory passages from swelling of the tissue or pressure from packs is usually expressed in terms of distress rather than in those of pain. Narrowing of the respiratory passages may be due to swallowing of the surrounding parts and must be anticipated by the proper placing of drains and the exercise of all possible measures to prevent inflammation. Much distress may be caused by a threatening dislocation of the parts as by the falling backward of the tongue when the genioglossal group of muscles are deprived of their insertion, as after the removal of a part or the whole of the lower jaw. In such cases the support must be supplied by some artificial means. Not infrequently patients will, in reminiscence, state that their greatest suffering was caused by a feeling that something was about to fall over their air passages.

So far in my discussion I have avoided the consideration of the part played in the control of after-pain by the nature of the anesthetic. In this we meet the most interesting problem in the control of after-pain.

I have already noted that nausea and tracheal irritation are much increased by inhalation anesthesia. That the electric knife cannot be used when the patient is under a general anesthetic is of course obvious. These facts all point to local

anesthesia as the method of choice in all operations about the mouth.

In attempting to determine the comparative amount of suffering the patients undergo in the methods of anesthesia many perplexing factors are encountered. In operations done under general anesthesia the patient is insensitive to all pain during the performance of the operation and for a varying period afterward, depending on its duration and on the profundity of the anesthesia. This period may in general terms be placed at from one to two hours. As the anesthetic is being recovered from the patient's imagination, and his tongue also, is loosened and he is apt to respond to his sensations in loud lamentations which make it difficult to accurately gauge his actual suffering. He is awakening at the time when the pain produced by the severance of tissue and the compression of the suture is at their height, and, therefore, is in a condition of highest impressionability at the time when offending stimuli are strongest. Since in general a patient may be said to be suffering as much as he thinks he is, we accept his interpretation at par. Save for the fact that the patient is made temporarily insensitive to pain a general anesthetic has no commendable features for use in intra-oral operations.

The use of local anesthesia opens the widest field for the exercise of talent in the control of after-pain. This comes about not so much because of the direct action of the anesthetic itself as from the range it gives the operator for the exercise of control over the many factors which have already been enumerated.

The actual duration of the anesthetic is a factor partly under the control of the operator. Speaking in general terms the duration of complete anesthesia, produced by novocain-epinephrin and drugs of that class, is two hours and partial anesthesia for an hour longer. At the expiration of this time the wound pain from severed tissue has ceased and there remains only the pain due to constriction by ligatures and sutures. The pain due to the reaction of the tissues and the general factors above enumerated follow later. Quinine and urea hydrochloride give an anesthesia lasting many hours or even days. Theoretically, this drug should solve the problem of after-pain. A broader view shows how fallacious is this hope. The most any anesthetic can do is to control the pain from the incision itself and from the constriction by ligatures and sutures. Pain caused by deglutation, coughing or from inflammation cannot be controlled by anesthetics. While the soft parts may be made anesthetic for indefinite periods by quinine too much has been expected from it in the control of after-pain. Disturbances in wound healing and other secondary factors cannot be controlled by it. That quinine is the cause of the secondary disturbances is not true. One writer in defense of quinine states that no anesthetic is fool proof. This observation just about covers the ground so far as the general accusations against quinine are concerned, but the best of mound artists sometimes heaves a wild pitch, so also with quinine undue irritation may follow even to the experienced operator. With quinine more hemorrhage occurs during the operation tho there is less tendency to after-hemorrhage making tight packing less imperative than after the use of novocain. Quinine finds ideal use in tissues in which the cautery is to be used. The area of anesthesia produced by it includes the zone of irritation resulting from the eschar. Large cauterized areas may run a completely painless course.

Since most of the post-operative distress is due to factors other than those than can be controlled by any anesthetic, most operators will prefer to use novocain-epinephrin because it produces anesthesia with less attention to detail and makes the various steps of the operation less difficult.

Quinine may be used at a distance from the actual field of operation. Where the anatomical relations are such

that this is possible pain from inflammation may be controlled for long periods. As an example of this method may be mentioned a simple operation as the removal of an epulus. Novocain may be injected about the growth in order to secure its diffuse anesthetic and blanching effect while at the foramen spenosum a small amount of quinine may be used to anesthetize the trunk of the nerve.

Alcohol may be used for the same purpose by injecting into the nerve trunk in continuity. In this way pain may be controlled for an indefinite period. The use of alcohol would hardly be justified unless an operation were done in a patient suffering from some form of neuralgia.

In summary it may be stated that the use of an anesthetic the action of which endures for a long time offers a fascinating diversion for those to whom local anesthesia is more or less a religion. Taken as a whole the comfort of the patient will best be subserved by a careful attention to all the details of the operation, the most obvious of which have been recounted. Each type of operation, and the characteristics of each patient, must be worked out in the concrete. There is no royal (or shall I say democratic?) road to physical comfort for the patient nor mental tranquility for the operator.

## Discussion.

*Dr. Leo Stern, New York City.*

The contribution of the essayist to the control of post-operative disturbances is important to the anesthetist and surgeon alike. Pain, the central topic of this dissertation, may be defined from the biologic standpoint as an exaggerated general sensation resulting from abnormal local reactions, useful in the conservation of the individual to the extent which it directs attention to the disturbance of body conditions existing at its site of emanation.

It does not follow, however, that by its control a factor essential to the human economy is in danger of being eliminated simply because pain serves as an active warning of danger and a reactive spur to protective effort. To the contrary, there are physiological necessities for securing relief from pain which are more fundamental than establishing the mental relaxation of the patient. Modern researches have emphasized the evils attending the intense disturbances which are the variable result of an extended stimulus of pain.

Cannon has demonstrated the fact that digestion is curtailed in a two fold manner by pain sensation; the flow of the gastric juices is cut short, the mechanical contractions of the stomach in digestion are inhibited. At the same time, disturbance in the metabolism of the liver is effected which may terminate in glycosuria. The reaction of the adrenal glands causes permanent shock of various degrees. Crile's classic researches have directed further attention to these prostrating effects, in the ineradicable degenerative changes which occur in the brain and thyroid gland as a result of pain.

An estimate of the factors concerned in the production of pain, as enumerated by the essayist, is a most effective contribution to the study of its elimination. These factors may broadly be classified according to their origin as general, local and psychic.

Recognition of pain is produced thru the activity of the autonomic nervous system referred to the peripheral fibres which are distributed widely thruout the body. The sensibility of each variety of tissue is normally dependent upon the number of these sensory fibrils present. The epidermis, periosteum and mucous membranes of the orifices of the body, including oral and naval cavities, are abundantly sensitive; while subcutaneous and submucous tissues, ligaments and bone are comparatively devoid of sensation. In pathological tissue neoplasms, with the exception of their peduncles, are fairly insensitive. Inflam-

matory tissue, either acute or chronic, is hyperesthetic; in confirmation of this attention is directed to the exquisite sensation retained by dental granulomata even under local anesthesia.

A final modification of the intensity of pain is the psychic effect of an individual's constitution and environment. Diversion and the conscious will to ignore the existence of pain are potent in ameliorating its intensity. Post-operative pain and, to a certain extent. disturbances which intensify this discomfort, may be effectively inhibited by practical methods based upon consideration of the foregoing principles. It is not within the scope of this discussion to emphasize the importance of eliminating the pain incident to operation, excepting as such procedures modify the foregoing factors. To this extent it must be realized that general anesthesia always exerts a debilitating effect both from the intoxicating debauch the patient undergoes and from the fact that pain stimuli continue to reach the brain by way of the sensory nerves. As the essayist has stated, "The patient is apt to respond to his sensations in loud lamentations," a phenomenon which is only partly ascribable to the increased impressionability at the moment of transition to consciousness; either has paralyzed the motor apparatus of the patient as effectively as would a dose of curare, but the ability to truly comprehend pain is hardly more diminished. The subsequent debilitating strain and its results in retarding constructive metabolism is vital in maintaining post-operative discomfort. In consequence, the first step to be instituted in the reduction of post operative pain is the employment of a system of anesthesia which permits the least amount of untoward effects on the host. This is best conformed with by Crile's technic of anoci-association, comprehending the pre-operative use of sedative drugs, a combination general and local anesthesia and post-operative dulling of the psychic thru the depression of the cerebral cortex by suitable anodynes. Suitable modifications for minor cases may be instituted, depending mainly upon local anesthesia.

Due consideration must also be given the patient during the actual operative procedure. Often the surgeon's technic is overburdened with attention to detail which means unnecessary local destruction and too extended anesthesia. His mind is too often focused upon performing a pretty operation and the patient is left out of the picture. Technic is designed as a general outline; it should be adhered to no more closely than the exigencies of the case demand. Morris has named this the "Physicians' Era in Surgery." Structure and function should be disturbed as little as possible. Small incisions, sharp dissection, rapid work and the considerate placing of sutures are all conductive to rapid resolution and a minimum of complications.

I concur with the dictum of the essayist that free drainage must be established to avoid the pressure of accumulated exudations, with the proviso that the manner and material of the drain is appropriately designed to disturb the process of repair as little as possible. Packing and stuffing with gauze is inimical to ideal results. Tissues are naturally distended and irritated by the presence of a foreign body; extensive lymph exudation takes place and apathetic healing and pain result. In pus cases it is my custom to employ a fine capillary drain of rubber tissue with gauze center. In aseptic wounds the exudate is carried off by a suture of fine linen tape extending onto the wound, removed after two or three days when local reaction is completed.

The essayist cautions us to avoid as far as possible the passing of sutures thru sensitive tissues. This is especially to be urged in dealing with the epidermis. In most oral conditions necessitating capitation of divided skin, adhesive tape is effective for securing primary union. In extensive wounds, or those

requiring great traction, nothing has been found more effective than the method of corset-lacing with tape advocated in some instances by Carrel.

The final measure in the elimination of pain is actual anesthesia of the wound. A procedure that is useful in retentive wounds is filling the recess subsequent to phenol cauterization with a paste of borated vaseline and orthoform in equal parts. This affords an analgesia of ten to twenty hours duration. For wounds that are not sufficiently retentive, post-operative nerve blocking with quinine and urea hydrochlorid has been found effective in producing an anesthesia lasting several days. This preparation, in spite of what has been said, must be used with a great deal of caution as edema often takes place at the site of injection even with the most elaborate precautions. Very slow injection of one cubic centimeter of a one-quarter per cent. solution around the nerve foramina is recommended in selected cases.

In conclusion, it must be remarked that surgery is an undesirable interference with natural conditions at best. Let us, therefore, do our work in this direction as expeditiously as possible by rapidly eliminating diseased tissue, leaving normal structures as we find them.

*Dr. Don. M. Graham, Detroit, Mich.*

In the field of dental and oral surgery we have had many papers and discussions on the subject of the prevention of pain during operations, but little if anything has been said of post-operative pain. Indeed, a goodly part of the programs of dental meetings of the last few years have been made up of discussions on the prevention of pain during operation. Conceding time and proper technic the dental surgeon can, with the means now at hand, such as high pressure, analgesia, infiltration and conductive anesthesia, and so on, operate painlessly on dental tissues without any concern as to after-pain. Unfortunately this cannot be said of oral surgery where post-operative pains are often most distressing, disconcerting operator as well as patient.

So far as I know, this is the first paper on post-operative pain presented before a dental audience and Dr. Hertzler deserves our thanks for presenting so timely and important a subject and one which, I feel certain, is next in line for solution. Up to date surgeons generally seem to have been content to ignore post-operative pains and have accepted them as a necessary evil to many operative procedures. It is surprising and disappointing how little has been written into surgical literature concerning post-operative discomforts. Surgeons have been content with prescribing morphia, codeine, etc., while nurses and friends were expected to supply the necessary mental sedative to help allay often excruciating pain. It must be confessed that in the field of post-operative comforts there is much to be desired, especially in operations about the mouth and jaws.

Have you ever undergone a perfectly painless operation and afterwards suffered the tortures of the damned? The writer has had just such an experience. An absolutely painless operation on the nose and, at another time, one on the superior maxillary were each followed in a few hours by the most excruciating agony. The operator in each case seemed not at all concerned by his patient's discomforture dilating, instead, volubly on the painlessness of the operation. Naturally, since that time, the writer has been greatly interested in post-operative pains and is especially pleased that this subject is presented before this meeting.

I agree in the main with the essayist, especially with the statement that some operations about the mouth are most difficult, if not quite impossible to perform without post-operative discomfort. The severity of the pain depends upon the susceptibility of the patient and is influenced largely by nationality, temperament, state of mind and state of

health. Much also depends upon the tissues involved, whether they are richly supplied with nerve distribution, whether they have undergone inflammatory processes, and whether they are susceptible of good drainage. It can be said that no two persons will react alike. In the same individual and seemingly under similar conditions the extent of post-operative pain will vary greatly. In the extraction of the third lower molars, for instance, we will have a number of common factors, but how often will we have patients complaining of one side only. It would indeed be a rash man who, at the conclusion of the operation, ventures to prophesy which side will be most troublesome as regards post-operative pain. I agree with the essayist so generally that I would like to repeat and perhaps emphasize some of the things he has so tersely stated. It is common knowledge that most operations about the jaws and face will be attended with considerable after-pain and discomfort. Speaking personally, this has been so uniformily the rule that the writer has made it a practice to say to patients, so grateful for painless operations, that they are not to be surprised if considerable pain, swelling and inconvenience follow these operations. It is also apparent that this is the most universal experience, if we are to believe the remarks of patients and the confessions of our frankly honest oral surgeons.

The very uniformity of such occurrences is possibly the reason why oral surgeons have not heretofore given this subject the thought and study it deserves. Dr. Crile is undoubtedly entitled to the credit of awakening interest in this neglected subject. To him is due unquestionably much of the enthusiasm and interest shown in local anesthesia by surgeons whenever this anesthetic is practical.

The writer is pleased to report a decided improvement in post-operative discomforts in his own practice and will, in the next few moments allotted to him, try to account for this improvement. Better asepsis is undoubtedly the most important factor in lessening the number of these cases of after-pain. Greater care in the sterilization of the field of operation, the instruments and the hands as well as the dressings, etc., will greatly reduce the duration and severity of post-operative pains. The choice of anesthetic is local when practical. An isotonic, sterile, local anesthetic, carefully and slowly injected without undue pressure will go a long way toward conserving tissues and will prevent for several hours at least the severest of these after-pains. Under a local anesthetic the tissues, as a rule, can be more carefully and more gently manipulated and with less traumatism than under a general anesthetic as we have the coöperation of the patient rather than his opposition.

Dr. Hertzler has well stated that the greatest care should be taken in ligating tissues to prevent inclusion and compression of nerves. Undoubtedly, too many sutures are inserted. Especially is this true regarding intraoral operations. When underlying bony structures are skillfully manipulated, few sutures will be required. In operating on bony tissues of the mandible and maxillae, no sharp or ragged edges should be left to impinge on sensitive nerve endings or nerve trunks during the repair process. There is a disposition with most of us to stop just short of completing a smooth and even osseous surface over which sensitive tissues may comfortably rest during the repair process. Not only does the removal of these rough and ragged edges prevent much after-pain, but it also hastens repair.

Dr. Hertzler was silent on therapeutic medication. I suspect that he has, like most of us found little virtue or value in their employment. Morphia is undoubtedly efficacious but too depressing and nauseating. Codeine is less depressing, but also less efficacious. So one might proceed down the line of new

drugs and combinations of drugs, getting results sometimes and again, apparently under similar conditions, failing completely in affording relief. It would appear that something must be done if we are to retain the esteem of our patients who suffer from post-operative pains. The administration of some sedative, such as morphia or codeine, is not only justifiable but almost imperative in some of these cases to tide over this critical period which, fortunately, is usually of short duration. For intra-oral wounds, where much inflammation and contusion are present, continuous irrigation with hot normal salt solution, or a saturated borax solution has been found by the writer to serve the purpose better than anything else and has displaced almost completely drug medication.

This paper and the discussion following its presentation are sure to bring us a little nearer the solution of the problem of post-operative pains.

*Dr. William J. Lederer, New York.*

The paper presented by Dr. Hertzler is of interest to me, not only from the view point of the oral surgeon, but it is significant, indeed more than that, that the author, a medical man and evidently a general surgeon, presents a paper before a dental convention; this emphasizes the relationship existing between medicine and dentistry, giving the latter its true stamp, namely that of a medical specialty. It is, therefore, with double interest and appreciation that I avail myself of the opportunity to participate in this program.

The real value of an essay to its audience is measured by the discussion it elicits, and a paper, no matter how scientific, which does not bring forth a certain amount of discussion among its hearers is inferior in actual practical value to a less scholarly effort which brings out different opinions and thus serves to present several aspects, varying experiences and different methods of procedure. Disagreement is always the basis for final truth; as long as we disagree we are learning. When we cease to learn, we stop making progress and when the time finally comes that we all agree upon a certain subject, we do not need papers on that which we all know. So, if I do not agree with all that Dr. Hertzler says, it simply means that I am seeking for final truth, and those who seek learn.

The author begins his essay by a general consideration of after-pain, regardless of the anesthesia employed, and he classifies the causes of after-pain under four headings:

1. Pain as the result of severance of tissues.

2. Pain as the result of effort of the operator to restore the continuity of tissues by sutures, and ligatures to check hemorrhage.

3. Pain as the possible reaction in the tissues from infection.

4. Headache, pain from deglutition, nausea and general constitutional disturbance.

In discussing post-operative pain in oral surgery, we primarily have to bear in mind that oral surgery, as such, deals mainly with operations on the tissues in and about the mouth and jaws. It does not ordinarily include surgery of the neck, brain or ear, the field of operation being limited by the pharyngeal wall posteriorly, the floor of the orbit superiorly and the buccal floor inferiorly; in other words, it deals with surgery of the mouth, jaws and their contents. This constitutes a branch of general surgery, but the tissues in and about the mouth react somewhat differently than most of the other structures of the body, having primarily a vast amount of resistance, and in operating upon these tissues it is not necessary to carry out such surgical technic as is employed in other localities of the human economy, being in the main bone surgery. Dr. Hertzler, taking the viewpoint of the general sur-

geon, at times overlooks the above mentioned facts and also that the majority of oral surgical cases are intraoral and maxillary in character; therefore bonework.

The cutting of non-infected tissue in the buccal cavity causes very little pain. In fact, in infected areas where pus is pent up it gives distinct relief and, if there obtains a breaking of the continuity, unless it occurs in the tongue or lip, which are extremely vascular, we ordinarily do not employ ligatures. Lingual and labial wounds are directly sutured without ligatures. Wounds of the buccal floor may require clamping and ligatures. Altho buccal lesions are constantly brought in contact with bacteria, infection is comparatively rare. It is a different proposition if an extra buccal wound becomes continuous with the mouth and buccal secretions enter the same. A smear of buccal bacteria introduced into the peritoneal cavity will cause a severe reaction, whereas in the mouth itself little changes will occur. Headache and constitutional disturbances follow mouth operations to a lesser degree than in surgery carried out in the gastrointestinal tract and elsewhere. If these conditions obtain they are usually the result of the anesthesia and can be avoided. Some of the tissues in and about the mouth are almost the least sensitive of the entire body.

*Pain from ligation.* Excepting in staphylorrhapy and actual resections and extensive extra oral operations (neck surgery), mouth surgery hardly requires ligation of vessels. Sutures are used less often in the mouth than in any form of surgery, tho a root amputation or closed cyst operation may require one, two, or half a dozen stitches, so that the suture pains are largely eliminated. Besides, sutures should only be used to approximate the tissues and not to exert traction. Of course, I appreciate that operations about the deglutition apparatus will require stitching, but these are exceptional cases. Ligatures about the nerves are unknown to me. Bone sutures in fractures are rarely used, the break of continuity being overcome by ligating the teeth. Once the fracture is reduced there is very little pain. Styptics occupy a very limited field in mouth surgery, packing being to my mind the method of choice for stopping hemorrhage. A good deal of the bleeding in the mouth stops by itself, and the actual cautery is not used as much here as in other parts.

*Pain due to wound reaction.* The author says: "Most wounds produced by the surgeon heal without notable reaction, but in operations about the mouth practically all wounds become infected." Maybe I can boast only of dumb luck, but I am happy to state that my cases as a rule do *not* become infected after operation. The author advocates the use of the electric knife, I must admit that I never saw it used. The author says, "When used for the purpose of limiting infection, gauze impregnated with some powdered antiseptic is most efficacious." I only use one kind of gauze in my work and that is iodoform gauze. In packing, however, care must be taken not to pack the gauze too tightly.

*Pain due to secondary factors; headache, vomiting, coughing, respiration and deglutition.* I hardly agree with the author in the advocacy of cold applications and the giving of coal tar preparations, tho the latter do prove useful in controlling pain, at times, however, opiates have to be resorted to. In cases where food cannot be taken per mouth, rectal feeding, hypodermoclysis, the stomach tube and the large catheter have their place, tho it is rare in the ordinary course of oral surgery that we are called upon to employ these means. Vomiting can mostly be avoided by skillful anesthetists, also by preventing the swallowing of blood, by loosely packing the pharynx with a layer of gauze, or by using intratracheal anesthesia. Rectal anesthesia also has its advantages if general anesthesia must be used.

From the foregoing one might suppose that there is no such thing as post-operative pain in oral surgery. Such, however, is not the case. We do get it after difficult extractions and impactions of third molars, particularly in the mandible, when infection exists before operation. Gauze packings which are too tight will cause considerable pain. A wound improperly drained, or granulations left behind will cause pain. But these are all faults of the operator and are avoidable. It is truly remarkable how little after-pain extensive oral surgical operations produce. I have time and again been agreeably surprised to have patients after extensive removal of bone area return to me for dressings and say, "Doctor, I have had no pain; only a little soreness." I operate on about ninety per cent. of my cases under local anesthesia, which emphasizes the author's statement, "Save for the fact that the patient is made temporarily insensitive to pain, general anesthesia has no commendable features for intraoral operations." This one feature does not hold good as local anesthesia properly employed also eliminates pain completely. Quinine and urea hydrochloride have never become a part of my armamentarium as the sloughing which I have produced in some cases prompted me not to use it. We do not use it in the hospital with which I am associated where we have surgeons of international reputation.

The author says, "Since most of the post-operative distress is due to factors other than those that can be controlled by any anesthesia, most operators will prefer to use novocaine, epinephrin because it produces anesthesia with less attention to detail and makes various steps of the operation less difficult." This is true, particularly as the operator never needs to consider speed in operating under local anesthesia. If I say local anesthesia, I refer nonreservedly to novocaine. I have not used cocaine in six years. If I use a general anesthetic at all, I combine nerve blocking with it because the patient is not only made insensible to pain but, what is very important, I reduce shock by cutting off afferent impulses and the lasting local anesthesia gives the tissues physiologic rest after operation, which is very essential. Oral surgery without local anesthesia would be nearly impossible for me; if I had to give up either local or general anesthesia I would not have to choose long; local anesthesia every time for me, because I effect not only a painless operation but I can avoid most of those unpleasant symptoms which so frequently follow an operation.

I thank Dr. Hertzler for the opportunity of hearing his paper, and thank the Section for the privilege of discussing it.

*Dr. J. P. Henahan, Cleveland, Ohio.* This subject is certainly of great importance to the patient. The wounds which we create in the mouth in oral surgery, if they are not infected, readily heal. We do not often have after-pains in the great majority of extraction cases, and when such pain does occur it is due to a cause which is invariably bacterial. In my opinion the proper way to take care of after-pain is to prevent it. In the ordinary tooth socket if we have not caused great lacerations of tissues there is no pain, but on the other hand if in removing a tooth the normal outline of the socket is destroyed we cannot rely on the usual means of preventing infection,—relying on the blood clot. We must then take steps in some other way to prevent infection from developing.

Most of what has been said in discussion has covered my own experience. In the matter of dressings I have little to say, but I will refer two agents which I have found useful.

In treating wounds resulting from the removal of an impacted lower third molar, or upper cuspids, for instance, I have found dressings of gauze to be con-

traindicated; there seems to be a good deal of irritation attending their use, in fact permanent dressings in my experience have not produced nearly such good results as oft repeated irrigation. In addition to the solution, I employ a dressing bearing the characteristics of both an anesthetic and an antiseptic or anodine. The best agents of this type are Orthoform and chlorotone; each are rather insoluble in water. Orthoform is a drug, which under present conditions, resulting from the war, it is very difficult to procure. My search for a substitute has resulted in the employment of Chlorotone. Orthoform gave very good results when employed as a dusting powder, placed in the socket and protected by loose cotton to prevent its being washed away by the fluids of the mouth. Chlorotone is very soluble in glycerine and the essential oils. It is antiseptic and anesthetic in its action. A very good prescription is put up by Parke-Davis & Company under the name of Dentalone. The advantage of using this lies in the fact that the essential oils prevent the dressings from fouling and will bring the patient back in twenty-four hours with the dressing still bearing that odor. The wound has not been reinfected by the dressing itself as is the fact when dressings of other kinds are employed. The tissues are constantly in a state of physiological rest, a condition which Dr. Crile draws attention to as aiding toward rapid healing. When absolutely necessary these dressings will remain for forty-eight hours and still be in much better condition than any other dressing which I am familiar with. It is applied on loose cotton barely large enough to fill the wound in a loose manner.

*Dr. L. M. S. Miner, Boston, Mass.* There is one preparation which has given me great satisfaction and that is a solution of guaiacyl and glycerin, and I find this to be the best preparation for the relief of pain. Orthoform is of service also, but guaiacol and glycerin in equal parts is an almost unfailing agent for the prevention of after-pain.

*Dr. Hertzler.* There is little to add, but I might say that by adding adrenalin to quinine the degree of edema can be controlled. One cubic centimeter will not produce edema and this is very frequently a sufficient amount to produce anesthesia. Regarding the use of powdered antiseptics in the mouth, I am glad to hear from Dr. Lederer that somebody has the courage to use iodoform in a patient's mouth. I did not think that could be done outside of Germany. As to the question of infection, I have never seen a wound in the mouth unattended by factors inimical to healing. As to the question of the electric cautery, Dr. Lederer has explained why he does not use it inasmuch as he said he had never tried it. But once acquainted with its intelligent use, I am sure he will become an advocate of the appliance. Oral surgery is more extensive than has been suggested in part of the discussion; in carcinoma of the mouth you sometimes have to follow it to the clavicle; if you don't do that, you stop short of being what an oral surgeon ought to be. There is much in favor of what Dr. Lederer said, that in local anesthesia you produce more or less irritation, but I believe that to be outside the pale of my paper. The same thing applies to the use of general anodynes; morphia is likely to cause the patient to sleep immediately after the operation, permitting the secretions to slip down the throat, adding to the deleterious effect. I personally never use anodynes before operation, and seldom afterward. The care in selecting the secondary factors, the mouth wash, etc., must be carried out in endless variation and for the comfort of the patient, but that belongs rather to the nurse than to the surgeon.

# THE CARREL-DAKIN TREATMENT OF WOUNDS.

By George Loewy, M. D., New York.

(Read before the National Dental Association at Its Twenty-First Annual Session, New York City, N. Y., October 23-26, 1917.)

I REGRET very much that Dr. Carrel could not have been here to present this subject to you. However, in his absence, I will try to interpret the work he has been carrying on in France in the treatment of wounds.

The principles for the treatment of wounds which I will describe have been developed in the course of two years by a group of men with which I have had the privilege of being associated. The methods found are of such kind that it requires the team work of men trained along different lines. This group is composed of five surgeons or medical men, Drs. Dehelly, Guillot, Woimant, Dumas and Audigane; of a mathematician and physicist, Captain Lecomte du Nouy; of two chemists, Dr. Dakin and Dr. Daufresne, and of a bacteriologist, Dr. Vincent. The purpose of the method is to prevent or to stop suppuration, to sterilize the wound and close it. These results we have succeeded in obtaining, but the method involves no new principles. It is derived directly from Pasteur and Lister. No new surgical procedures are invented. The technics we use are known to every surgeon. Neither is the method characterized by the use of any new chemical substance, the antiseptic power of hypochlorite of sodium having long been recognized. The results have been obtained by systematizing these old procedures in a new way. This new systematization has been brought about by the application of two quantitative methods. Accurate measurements are the necessary conditions of scientific progress. The use of the scale causes the wonderful growth in chemistry. Medicine is so slow because of the failure to use quantative methods. The two methods which we have employed are simple ones. The first is that of measuring the volume of infection and of following its increase or decrease; the second is that of measuring the progress of healing by means of a technic based on the discovery of some of the laws of cicatrization. Thus the volume of infection and the rate of healing are accurately measured and it becomes possible to handle the infection without interfering with the cicatrization. It is only after thousands of observations and clinical experiments that the method was considered as established. This method may be defined as a combination of procedures consisting of four parts: (1) Mechanical sterilization. (2) Chemical sterilization. (3) Bacteriological control. (4) Closure of the wound. None of these parts can be separated from the others; all are essential to the successful treatment of wounds by this method.

1. One cannot sterilize a wound properly by chemical methods unless it is first sterilized mechanically, and one cannot close the wound until it is shown by the bacteriological control to be as-

eptic. The problem of mechanical sterilization of a fresh wound is a very simple one as we have worked it out in our hospital at Compiegne, especially by Dr. Dehelly. The surgical cleansing of a wound must be made not at the first aid dressing station, but at the casualty clearing station. The casualty stations are usually situated from five to seven miles from the front lines, and when the patients are brought to these stations the mechanical cleansing can be effected by large incisions opening to the deepest parts of the wound. After the wound is laid open and explored for shell fragments, pieces of clothing, or other foreign bodies, every particle of foreign matter is removed. This is easy to do if one receives the patient a few hours after he has been wounded. The bacteria are usually carried by particles of clothing or other foreign bodies, and are easily removed from the surface of the tissues by the mechanical sterilization of the fresh wound. I would emphasize very strongly the necessity of thoroness in the removal of all foreign bodies, since it is from these that gas bacillus infection usually starts, and pieces of clothing are likely to carry the spores of the Welch bacilli. Blood clots must also be carefully removed and hemostasis made, because bacteria are located in the blood clots and the hypochlorite cannot rapidly dissolve the blood clots. If the patient is received a few hours after being wounded, in many instances the wound can be mechanically cleansed and closed. But immediate closing of a wound is not a scientific method. One is justified in using this method only when he is absolutely sure that the patient cannot be evacuated for ten days; otherwise a primitive suture should never be made. The treatment of old suppurating wounds is different. In many instances of suppurating surface wounds this mechanical cleansing and washing with neutral sodium oleate and water brings about a surprising degree of sterilization, tho it may not last long. When one is dealing with old suppurating wounds with fractures, the problem is very much more complicated. In this class of cases a surgical operation should not be attempted until at least ten days after the infection is decreased by chemical sterilization. Only such surgery as is absolutely imperative should be made at this stage of infection. The suppurating wound is treated by chemical means, and when the infection is reduced as much as possible, the necessary surgical cleansing is performed. It is then completed by a new and thoro chemical treatment.

2. The chemical sterilization in itself is a comparatively simple procedure and can be defined as a combination of processes by which chemical substances are used under specific conditions of contact, concentration and time, for the purpose of securing surgical asepsis. The antiseptic substance is an instrument. It plays the same role as a scalpel in a surgical operation. One should be selected which best fits the purpose for which it is to be used. Surgeons use different kinds of antiseptics just as they use different kinds of surgical instruments. We must have an antiseptic which kills the bacteria but does not destroy the tissues. In order to know the practical value of an antiseptic, we must have a measure of its action on the bacteria and on the tissues. This is made by measuring the volume of infection and by the proper use of the algebraic formula of Captain du Nouy. Among the excellent substances studied by Dr. Dakin, at the beginning of the war, Dr. Carrel selected two, sodium hypochlorite and chloramine-T. He gives the name of Dakin's solution to sodium hypochlorite, deprived of its alkalinity, in order to distinguish it from Labarraque's solution which contains a great deal of alkali. Chloramine-T, which is soluble in water and has a high antiseptic power,

differs from sodium hypochlorite in that it does not dissolve necrotic tissues and is less irritating, and may be used on skins which are more than ordinarily sensitive. Almost the same results may be obtained with magnesium hypochlorite, but it is less satisfactory than sodium hypochlorite because the magnesium dissolves very little of the necrotic tissue. Flavine and dichloramine-T dissolved in oil and several other substances have been experimented with and found far inferior to hypochlorite and chloramine-T. Comparison of the curves of sterilization and of cicatrization show that the neutral hypochlorite of soda in 0.45 per cent. solution, used twelve times in 24 hours, sterilizes a wound without producing any destruction of the tissues. Extensive experimental work was made by Daufresne in the properties of sodium hypochlorite. The action of hypochlorite on bacteria is rapid. Most of the micro-organisms are destroyed in one or two minutes by sodium hypochlorite and in five or ten minutes the hypochlorite is then destroyed by the tissues. Sodium hypochlorite destroys plasma, clots, necrotic tissues, and blood clots, while chloramine-T and dichloramine-T in oil does not. The methods of making hypochlorite have been very much simplified. Daufresne found that potassium permanganate stabilizes hypochlorite. Then electrolytic hypochlorite can be used. Afterwards in this country it was found that a very simple method of preparation is to bubble liquid chlorine thru sodium carbonate. Daufresne mixes in a certain way Dakin's chloramine-T with sodium stearate and obtains a paste which gives up slowly the antiseptic substance and is very much more severe than dichloramine-T in oil.

It should be remembered that the efficiency of an antiseptic is due chiefly to the way in which it is used. In the treatment of wounds the three important conditions in connection with its use are contact, concentration, and time. Contact is highly important. It is plain that the solution can sterilize only the tissues with which it comes into contact, and that is why the surgical and mechanical cleansing are so important. The mechanical cleansing has to be so thoroly done that every part of the wound can be reached by the chemical substance. Then small rubber tubes with a number of perforations are used to carry the solution to every part of the wound. The second condition is concentration. When the antiseptic solution comes into contact with the surface of the wound it is destroyed, and it is diluted by the secretions from the wound, with the result that in a very short time, fifteen or twenty minutes, no active substance remains. Proper concentration can be kept up only by bringing the antiseptic constantly to the wound. It is found that a wound flushed every two hours becomes sterile. In mildly infected wounds the Daufresne paste keeps at the surface of the wound a sufficient concentration of chloramine-T. When this paste is applied to the surface of a wound the sodium stearate disappears and chloramine is brought to the tissues. But this technic is successful only when the amount of suppuration is small. It would be useless to attempt to sterilize an abundantly suppurating fracture with a small amount of chloramine-T such as can be contained in the cavity of the wound. Antiseptic flushing should be used. The third condition to be considered is that of time. It is not possible to sterilize a wound in a few hours. A surface wound may be sterilized in 24 hours, but generally in war wounds it takes a longer time. The treatment can be stopped only when the bacteria has disappeared or almost disappeared from the smears taken from the wound, and then the wound can be safely closed.

3. The third factor in the treatment is the bacteriological control. Without

knowing the degree of infection and without following the progressive decrease in the number of bacteria it would be impossible to know whether the technic is carried out in the proper way or when the wound should be closed. When a large number of wounds have to be watched it is found impossible to use the ordinary bacteriological methods. The only way that seems practical is to take smears and count the bacteria on the surface of the smear. This method is inaccurate but has been found to be very good from a practical standpoint. The smears are taken every two days from the back parts of the wound and the recesses in which infection would be most likely to lurk. It is important to know, not the average bacterial count, but the condition of the more badly infected part of the wounds, because it does not matter if nine-tenths of a wound be sterile, if one-tenth remains still infected. The work of counting the bacteria can be done by mere technicians. It is possible to examine 30 or 40 slides per hour, and as the examinations are made every other day a large number of wounds can be examined bacteriologically. The bacteriological chart of every wound is plotted and gives to the surgeon the necessary information about the condition of each wound. It tells when the antiseptic is properly applied and when the wound can be closed. When the time is reached that only one bacterium is found in five or ten fields, the wound is said to be surgically sterile and may be stitched with safety. Some bacteriological charts are as characteristic as are the temperature charts in typhoid fever. In suppurating surface wounds where there is no necrotic tissue there would be a sudden drop in the number of bacteria, from a large number to one in five or one in ten fields, after 24 to 48 hours, but where there is necrotic tissue the count will remain high for two or three days. In cases of deep wounds the drop in the bacterial count is generally slower. The curve is especially characteristic in cases of suppurating fractures, if the wound contains some foreign body. The count will be very high and will then drop to about ten per field. If one operates on these cases and removes the foreign body the count will go up to 100 or more, and after two or three days would drop to one per five or ten fields. After a few weeks' experience one may diagnose the case at first sight of the curve, determine the character of the complication, and tell the process to be followed in the treatment. When the bacteria has disappeared, it does not mean that the wound is bacteriologically aseptic. Dr. Vincent found that only about 30 per cent of the surgically aseptic wounds were bacteriologically aseptic. But when the count has dropped to one in five or ten fields, the wounds can be closed. When one is dealing with a surface wound or a wound of the soft parts, the wound can frequently be closed after two days of asepsis; but in cases of fracture, one has to be very careful and study the clinical symptoms as well as the bacteriological curves. When both clinical symptoms and bacteriological chart agree, a fracture, say of the thigh, may be closed after five or six days after the wound is found surgically aseptic.

4. For the closing of the wound, which is the fourth step in the method, there is no special procedure to be used. The wounds are closed by strapping with adhesive plaster in the cases in which the wounds are sterilized in less than ten days. When there is a loss of skin the elastic traction method is used. In most of the cases the wounds are stitched. No drainage is made. When the patients are brought with already suppurating wounds, especially with fractures, the closing has to be done by following the rules studied especially by Dr. Guillot and Dr. Woimant in Compiegne. About

60 per cent. of the old suppurating fractures of the thigh can be sterilized and closed.

I can best illustrate the results of the application of the principles which I have described by means of lantern slides (Dr. Loewy then showed characteristic bacteriological curves, and demonstrated the manner in which the curve of cicatrization should follow the calculated curve in a properly treated wound, the manner of arranging the perforated tubes and the dressings, emphasizing the point that the dressing should be loosely packed about the tubes and that in changing dressings one should never touch the granulating surfaces. He showed the results obtained in fractures and stated that a great many suppurating fractures could be sterilized and closed thus avoiding amputation in many instances and saving much suffering.)

Our conclusion after three years' experience is that suppuration can be arrested and that no patient's wounds should be allowed to suppurate for more than three or four days after his coming to the hospital. Septicemia can almost always be prevented and a great many limbs can be saved. At least 50 per cent of the amputations performed for infection could have been avoided if sterilization of the wounds had been effected. The time required for treatment is greatly reduced. As an average it is only 33 per cent. of the ordinary time. It should be remembered that a precise method requires more care than the old methods. But more systematized work in the hospitals, by the surgeons and their assistants will most certainly yield an immense improvement in results.

# AN EFFORT TO FIX A STANDARD OF CROWN AND BRIDGE WORK ON SCIENTIFIC PRINCIPLES CONSISTENT WITH PROPER REQUIREMENTS.

By Karl G. Knoche, D. D. S., Chicago, Ill.

(Read before the National Dental Association at Its Twenty-First Annual Session, New York City, N. Y., October 23-26, 1917.)

MR. CHAIRMAN, members of the Crown and Bridge Section of the National Dental Association; it is with great pleasure that I bring this subject before you and still with much trepidation at the undertaking.

The reading of a paper of this kind was to have been the lot of Dr. Forrest H. Orton, of St. Paul, who has given this subject a great deal of thought and attention. Unfortunately, he has been very ill and his recovery has not been very encouraging.

The purpose of this section is simple, and still very complex. Primarily, we are endeavoring to bring order and system out of chaos. No Art can become scientific without the adoption of some standard. Operative Dentistry floundered about until Dr. G. V. Black set a standard for it that made it scientific at once. His extension for Prevention, placed this branch of our profession upon a scientific basis. Crown and bridge workers have not been so fortunate as yet, but it is a hope of the officers of this section, that thru the work of the section, we may have a standard that will place this great part of the work of our profession upon a scientific basis. In other words, we are endeavoring to lead the crown and bridge workers to a point where their efforts will be based upon truly scientific principles and this will be accomplished only after we have proven and accepted standards of operation.

A very conservative estimate of dental operations based upon investigation of a rather rigid sort, shows that 15% or more of all dentistry done is crown and bridge work and only a partial survey of the literature of the day and of the work seen, soon drives into our consciousness that the great bulk of this work is doing more harm than good, in fact, is doing more harm than any other class of work. Still no research work is being done in a beneficial way by our profession. No investigation is being made as to why the work in this great field of Dentistry is doomed to failure. What work of this sort is undertaken, is done by individuals who, unfortunately, have to struggle hard to influence the few they reach. Some serious work should be done by the Research Commission and by the National Association thru this section if need be, and I earnestly plead that this section be a permanent part of the National Association. The work, as presented at this time, can but represent a start in the proper direction. We solicit the earnest support of the members of this section as well as the officers of the National Association. A great amount of work will have to be done, much investigation undertaken, and those interested in furthering this work will of necessity give

thought that is unbiased and open-minded.

I have personally felt the need of this work as I made a survey of my own too many failures and tried to analyze them. The profession is very much at sea, largely because so much has been left undone in a connected way. The teachings of some one man or group of men has been followed, only to be torn down and ridiculed by another man or group of men. The profession has been swayed too easily by professional likes or dislikes and the true merit of much, has been overlooked by the failure to be open-minded. We should know first what bridge work is, what should be accomplished by its use, what it should be and what it should not be. This requires also a standard of criticism. We should know what the essential principles are and, by all means, have a classification of favorable and unfavorable conditions. This can be undertaken by our section and be of everlasting benefit to workers in this field.

There must be radical changes in the teaching of this great subject, for much blame for the failures can be traced to the Dental Colleges. A survey of work done in the majority of the colleges of this country proves that here we have the source of much that retards advancement along proper lines. The student is instilled with a mass of detailed technic and little attention is paid to the essentials. This is retained and the practitioner goes forth to enter this field with a mind unable to think along other than the presented lines. There are exceptions to this and we have men rising out of this condition to be individual leaders, but unfortunately, whose efforts are isolated and of less avail than those of the teacher in a college who directs the minds of a class of students varying in number every year.

The teaching in our colleges, for the most part, is done by men who have developed a certain technic and rarely is a man found who recognizes the fundamental principles involved or who will place them above the technic that he has developed.

Crown and bridge work is taught very largely as a side issue or a part of the course in Prosthetics. The subject is a large one and we know it is too important to be combined with that of another of equal importance, namely, Prosthetics. These two subjects should be taught separately and by men who can give sufficient time to do justice to the subjects. No man can give the proper instruction, to a class of one hundred men, in the essentials of crown and bridgework, by a series of lectures and turn the control of technic work as well as practical work, over to a set of Demonstrators drawn from the classes previously so trained. Little attention is given to Dental Anatomy, Dental Physiology, occlusion or articulation. To open the door thru which much truth and light may enter, allow me to advance the following thoughts: Dr. Orton has advanced a definition of bridge work that I will submit at this time,—"A method of correcting or perfecting malocclusion in an arch mutilated by the loss of one or more teeth."

This may require changes; but as it stands, is short and to the point. We realize that the malocclusion brought about by the break in a perfect arch following the loss of one or more teeth, produces many degenerative changes. It interferes with the functions of the organ of mastication and with the specialized functions of the individual teeth. Thus, we see that the primary purpose of crown and bridge work is the necessity of preserving the normal functions of the organ and of the individual teeth.

Let us present the essential principles that we believe should become the foun-

dation upon which crown and bridge work should be based, and take them up in an indiscriminate order and we shall see that one predominates the others. In other words, we have several essentials that contribute to a principle.

First of all, let us take Dental Anatomy and emphasize its importance. Dental Anatomy receives some attention as such, and then seems to be entirely forgotten when it comes to our Crown and Bridge work. Men who give a great deal of attention to Dental Anatomy in their foil, amalgam or inlay operations, forget it all when constructing a Crown or a Bridge.

When we speak of Dental Anatomy, we mean not only the occlusal restoration but the restoration of all tooth shape contours, etc. This is seldom done, and I will admit, is very hard to do by even the most skilled technician.

The results following the preaching of Dr. J. Lowe Young, on occlussal restorations, have been remarkable and far-reaching. The occlussal restoration is of vital importance possibly of greatest importance, in maintaining normal functions, but is only a part of the reproduction of tooth anatomy. The Gingwal contours, the contacts, the embrasures, the Buccal and Lingual contours, which if overlooked, allow food to pack against the Gingwal tissues producing inflammatory changes, must all receive proper attention if we wish to have our work function properly and fail to be an agent of destruction.

Next, let us take up occlusion. While not of greatest importance, it has been emphasized very much. Perfect occlusion is very vital in order to maintain the proper balance of stress, etc., necessary for proper function of the organ of mastication. However, we may have a perfect occlusion but a very imperfect articulation, and our perfect occlusion stands for little. This may occur in mouths where a great amount of wear has interfered with a proper articulation and still worn itself to a perfect occlusion.

It is unfortunate that while we may have so-called articulation, that they will not give us perfect articulation while they may give us perfect occlusion. This is easily demonstrated by taking a set of casts of normal teeth and try mounting them in any articulator. They will never produce movements necessary to follow the facets showing normal wear during the movements of the jaw in mastication.

There is being made, however, by Dr. Munson, of St. Paul, an articulator built on an entirely new principle, that I believe will revolutionize our theories with which it is possible to so mount cast of jaws, that all the movements of the jaw can be followed accurately. This promises to be of great aid to us in our bridge work in attaining perfect articulation.

In summing up, we find that all of the foregoing, all of our efforts in obtaining occlusion, articulation point to the maintenance of normal function. The reason that a tooth with a perfect occlusal reproduction is of great service, while one without is of little service and produces changes that soon become degenerative, is that it functions properly. We know that teeth have certain contours as for instance, the marginal ridge preventing the packing of food thru the contact point. The lingual and buccal contours that direct the food out into the mouth and away from the gingwal supporting tissues. This is definitely a function of the tooth as much as is mastication, so that our tooth form our Dental Anatomy has its reason in maintaining normal function of the organ as well as the especialized function of the individual teeth.

So it all points to normal function. We may have many things contributing

to the maintenance, but in obtaining normal function, we cannot overlook this fact.

Whether a fixed bridge is a menace to the wearer's health; whether partial plates should be made or matters of that kind, I do not propose to take up at this time, since we are only seeking to find a definite, unqualified principle or principles upon which to base our work.

Unfortunately, the economic problem is ever before the profession, and man must live and be as efficient as possible.

The fixed Bridge, the removable Bridge and the partial plate, all operations, now in the controversy, may be made better, more efficient, if the principles are carefully observed, or any one of them may be made worse by a total disregard for the factors that go to make up the principles.

A fixed Bridge, in the construction of which a man may have been painstaking in following out his Dental Anatomy, his occlusion articulation may produce a a bridge that protects the soft tissues, acts as a perfect part in the masticating function of the organ, that will be infinitely better than a Removable Bridge made without regard for the principles observed by the man who made the Fixed Bridge.

Operations of all kinds may be made more efficient by observing the principles and carrying them out in detail.

This is but the beginning of our work, and I hope a great deal will be done to bring this great branch of our profession out of the position it is in, into a position that is its due, and to do this, we must combine our technical skill with a deeper knowledge of the fundamental principles.

# The Research Department

CONDUCTED BY
THE RESEARCH INSTITUTE OF
THE NATIONAL DENTAL ASSOCIATION
CLEVELAND, OHIO

WESTON A. PRICE, M.S., D.D.S.,
*President*

SAMUEL E. POND, B.H., A.M., *Acting Research Director*

**All Articles from the Research Department are Censored by the Advisory Board of the Research Institute and The Journal Committee.**


# THE EFFECT OF HIGH PRESSURES ON BACTERIA.


**By W. P. Larson, T. B. Hartzell, and Harold S. Diehl.**

(From the Department of Bacteriology, University of Minnesota, and the Research Institute of the National Dental Association.)


THE work recorded in this paper is the result of an attempt to study the mechanism of immunity and incidentally to test a theory regarding the failure of vaccine therapy as practiced at the present time.

During the past 8 or 10 years bacterial vaccines have been used extensively, but, on the whole, with very unsatisfactory results. Were it not for the excellent theoretical foundation on which vaccine therapy rests, its use would probably have been relegated to the past. Bacterial vaccines, as used today, judged by the practical results obtained, are of little or no value aside from typhoid vaccine as used prophylactically and the undisputed value of staphylococci and B. acne vaccines, in certain types of cases.

Protective immunization experiments with killed cultures on laboratory animals have likewise not been crowned with marked success. Facts such as these may readily be gleaned from a survey of the literature. The conclusion would therefore seem justified that the dead organisms do not offer a suitable antigen for immunization processes.

During the past year while conducting some perfusion experiments on rabbits, we were much impressed by the rapidity with which bacteria were taken up by phagocytes. The particular experiment in question concerned the perfusion of the liver of rabbits with emulsions of staphylococci. By inserting cannulae in the portal vein and superior vena cava the liver could readily be perfused with

Locke's fluid, containing large quantities of staphylococci in suspension. It was found that a fluid containing 9,000,000 organisms per cubic centimeter could be sterilized in a few minutes by being passed thru this organ. The endothelial cells of the liver, on section, were found to be literally packed with bacteria following this operation. This observation suggested that vaccines injected into an individual for the purpose of immunization probably meet a similar fate. The phagocytes, whose function it is to seize any foreign material entering the body, failing to recognize the benevolent intention of the immunizer, probably take up the killed cultures with even more greed than the living bacteria. Metchnikoff[1] and his pupils have shown that the digestion of such incorporated particles by phagocytes may be very rapid, especially when it concerns dead bacteria.

It is a well recognized fact that an antigen which has undergone even partial digestion is no longer capable of stimulating antibody formation, and hence ceases to be an antigen. The natural deduction is therefore to assume that phagocytosis defeats, in a measure at least, attempts to immunize with killed bacterial cultures. Metchnikoff and his school would have us believe that the phagocytes are the source of antibody formation, but the evidence presented in support of this contention is far from conclusive.

If we now examine antigens, such as diphtheria and tetanus toxins, which are not in the form of particles, but in a diffused state and hence not so accessible to the phagocytes, there is little difficulty in attaining a high degree of immunity. An animal may likewise be given a few injections of foreign protein, such as egg white, with the result that a high titer of immune serum is formed. The exception to this rule would seem to be the immunization with tissue cells and red corpuscles in particular. A few injections of foreign red cells will usually give a serum with a very high lytic titer. This may, however be explained by the fact that tissue cells are taken up by the so-called macrophages, which are large cells with a rigid nucleus, and which are slow to arrive on the field of action. It is not improbable that the antigenic principle is dissolved from the injected cells by the tissue fluids before phagocytosis takes place. Prompted by these considerations an attempt was made to extract the antigenic principle from bacteria in a form not so readily accessible to phagocytes in the hope that it might give vaccine therapy the much needed "raison d'etre."

The conversion of bacteria from the solid or semisolid state to a state of diffusion is not an easy matter, owing to the firm outer membrane. Numerous investigators have subjected bacteria to various physical influences looking to this end, such as high pressure, shaking, freezing and grinding processes, but hitherto with little or no success.

E. Büchner[2] was the first to obtain definitely positive results by subjecting living cells to high pressure. By the use of a hydraulic press he was able to separate zymase from the yeast cell. Later, Hans Büchner,[3] by using the same apparatus, subjected bacteria to a pressure of 500 atmospheres in an attempt to isolate ferments and endotoxins, but with rather disappointing results. Certes[4] found that a pressure of 350 to 500 atmospheres had no effect on putrefactive processes. Yeast cells under a pressure of 400 atmospheres were still able to ferment sugar. The same investigator found that the pathogenicity of anthrax bacilli was not impaired after having been subjected to a pressure of 600 atmospheres. D'Arsonval[5] and Charrin on the other hand found that $CO_2$ under a pressure of 50 atmos-

[1]Metchnikoff: L'Immunite, 1901.

[2]Büchner, E.: Ber. d. deutsch. Chem. Ges., 1897, 30, 117.

[3]Büchner, E.: München, med. Wchnschr., 1897, 44, 299.

[4]Certes: Compt. rend. Acad. de Sc., 1889, 99, 385.

[5]d'Arsonval & Charrin: Compt. rend. Soc. Biol., 1893, 467, 764.

pheres destroyed B. pyocyaneus in 2 hours. Their work was repeated by Sabruzes[6] and Bazin, Schaeffer[7] and Freudenreich, and Krause,[8] all of whom failed to confirm the findings of the French investigators. In summing up the results of high pressures on bacteria Gottschlich[9] concludes that they have little or no effect.

In our work many pieces of apparatus have been constructed, but only those with which definite results were obtained will be described. We first studied the effect of a direct load of bacteria.

For this purpose a piece of nickel-chrome-steel was obtained from one of the large steel companies, which also kindly furnished us with an analysis of the material. A hole ⅞ inch in diameter was bored thru a piece of steel 5 inches by 3½ inches, and a piston, likewise of nickel-chrome-steel, was ground to fit the cylinder. One end of the cylinder was closed by a steel wedge. The cylinder, piston, and wedge were then tempered to withstand a pressure of 225,000 lbs. per square inch. The bacteria that were to be subjected to pressure were mixed with infusorial earth, after which they were placed in a leaden cup about 2 inches long and of a bore to fit the steel cylinder above described. The leaden cup, about two-thirds filled, was placed in the cylinder in an inverted position and forced to the bottom of the cylinder where it rested on a leaden disk which, in turn, rested on a steel wedge closing one end of the cylinder. The piston was then inserted and the apparatus placed in a testing machine such as is used by engineers in testing the strength of materials. The particular machine in question was capable of lifting a load of 200,000 lbs. The tests were usually inaugurated at 6 p. m. and terminated 14 hours later.

The following organisms have been studied in this manner: B. typhosus, B. coli, B. tuberculosis, B. proteus, B. subtilis, staphylococci, streptococci and pneumococci.

[6]Sabrazés & Bazin: Koch's Jahresb. f. Gärungsorganism, 1893, 34.

[7]Schaffer & Freudenreich, Ann. d. Micrographie, 1890, 4, 502.

[8]Krause: Centralblatt f. Bakt., etc., 1902, O., 31, 673.

[9]Gotschlich: Kolle-Wassermann Handb. d. path. Mik., 2 Aufl., 3, 460.

The pressures used ranged from 3,000-12,000 atmospheres. On termination of each experiment cultures were made on dextrose broth and, whenever possible, plates were made before and after the experiment. The general statement may be made that a pressure of 3,000 atmospheres was not sufficient to destroy any of the bacteria studied, while the pressure of 6,000 atmospheres for 14 hours was found to destroy all non-spore-forming organisms. The spores of B. subtilis were not regularly killed at pressures of 12,000 atmospheres. The bacteria would undoubtedly have been destroyed by these pressures in less time than that used; further studies are being undertaken to determine this point, however.

Having thus determined that it was possible to destroy bacteria by physical pressure, the question naturally arose as to the mechanism operative in this procedure. It was probably not a question of expressing the cytoplasm from the organisms, as was attempted by Büchner inasmuch as the pressure exerted on the bacteria was uniform from all sides. The small amount of entrapped oxygen in the container could scarcely be responsible for the phenomenon. It was also felt that the element of heat development could be ruled out without further consideration. Two factors were still to be considered: the direct effect of the pressure, and its sudden release. Which of these two was the important factor was, by the very nature of the experiment, difficult to determine, but it was not improbable that both factors played an important rôle in killing the bacteria. The interesting observation was made that bacteria subjected to high pressure were difficult to stain; as a rule only shadows could be discerned where it concerned gram-negative organisms, while the gram-positive ones usually lost their specific staining reaction.

It would seem probable from these experiments that the death of the bacteria was due either directly to the pressure

or its sudden release or to a possible combination of both.

In an effort to analyze more fully some of the problems which had presented themselves during the process of these investigations, studies were inaugurated to determine the effect on various bacteria of gases under high pressure, such as $CO_2$, H, and N. An apparatus was constructed for this purpose which would enable us to subject bacteria to various gas pressures and suddenly release it. The apparatus used for these experiments may briefly be described as follows:

A steel tube, 8 inches in length and 1½ inches in diameter, lined with block tin, was attached to the desired gas tank by a suitable coupling. The opposite end of the apparatus was fitted to a brass head containing a small receiving chamber. The bacteria to be studied were placed in a sterile test tube resting on a coiled spring in the bottom of the tin-lined steel tube. The receiving chamber was provided with a valve, connected with a glass tubing which extended to the bottom of the test tube containing the bacteria. The apparatus was then attached to the gas tank and left for the desired time. When the valve leading to the receiving chamber was opened, the pressure of the gas forced the bacterial suspension up the glass tube, thru the valve into the receiving chamber. The fluid so driven into the receiving chamber could be collected from a small spout into a sterile test tube. It will thus be seen that the pressure was released suddenly as the fluid passed the valve. The valve was under such control as to permit the removal of the fluid drop by drop if desired. We are indebted to Mr. David Crowther, Mechanician and Instructor in Dental Mechanics, University of Minnesota, for valuable mechanical assistance. We are indebted also to Dr. J. F. McClendon for helpful suggestions.

It was found that $CO_2$ under a pressure of 50 atmospheres would destroy B. typhosus, B. coli, B. tuberculosis, B. pyocyaneus, staphylococci, streptococci, and pneumococci in a period of time ranging from 1½-2½ hours. It was interesting to observe that the gram-negative bacilli could be brought to a marked degree of disintegration, altho disintegration of all the bacteria in suspension was never attained. The gram-positive cocci, on the other hand, suffered little morphologic change aside from slight irregularity in size, and often a tendency to lose their gram-positive character. The importance of suspending bacteria in distilled water instead of broth or physiologic salt solution was emphasized by the fact that when the latter were used very little disintegration of the organisms was noted. It was found that $CO_2$ of less than 40 atmospheres produced no effect whatever on the bacteria studied. Yeast cells were found to be unaffected by $CO_2$ after exposure to this gas for 48 hours. This may be due to the fact that yeast cells are normally active $CO_2$ producers, and their external membrane therefore probably offers little or no resistance to the $CO_2$ molecule. The osmotic equilibrium of these cells was probably not disturbed by the sudden change in the molecular concentration of the fluid. $CO_2$ likewise has no effect on the proteolytic ferments of B. pyocyaneus and B. proteus; these ferments were found to be as active after exposure to this gas at 67 atmospheres for 20 hours as were the controls kept at room temperature.

Having then found that bacteria could be destroyed by relatively low gas pressure, we were once more confronted with the problem as to the mechanism of the various physical and chemical forces involved in the experiment.

It seemed probable that the acidity of the $CO_2$ solution under the pressure used might be responsible for the killing of the organisms, altho their disintegration was evidently due to the sudden expansion of the dissolved gas. Being unable to find any work dealing with the degree of acidity of $CO_2$ solutions under pressure, experiments to determine the H ion concentration of this gas under various pressures were undertaken. The methods suitable for this particular experiment were, owing to its peculiar nature, limited. The colorimetric method

seemed to be the most feasible. For this experiment a steel tube 4 inches long and 1 inch in diameter was lined with pure block tin. The ends of the tube were closed with glass lenses, supported further by heavy steel burs. The indicator to be used was then placed in this apparatus which by means of a suitable coupling was attached to the $CO_2$ tank. Any change in the indicator could thus readily be determined. In order to be able to detect even a slight change in the indicator it was found nccessary to construct a duplicate apparatus always containing the same indicator which could be used as a control. The Ph was found to be between 10-3 and 10-4, tho probably nearer .4 than .3. It was found that the amount of pressure used had very little effect on the degree of acidity; in fact, experimentally, it was difficult to show any difference in the degree of acidity between 1 and 50 atmospheres' pressure, altho theoretically the Ph of $CO_2$ at 50 atmospheres is 10-3.15 and at 1 atmosphere 10-3.6. Our failure to establish any difference in the degree of acidity of this gas under various pressures was probably an insufficient number of indicators of the proper range were used.

The next logical step in this series of experiments seemed to be to determine the effect of this degree of H ion concentration on the bacteria studied. Hydrochloric acid, acetic and phosphoric acids were prepared to a H ion concentration of 10-3.15, the maximum theoretical acidity of the $CO_2$ used. It was found that B. coli and the staphylococcus would live from 7-10 days in the hydrochloric and acetic acid of this acidity. The phosphoric acid (which is not buffered appreciably by proteins) was found to be more injurious to the organisms. However, both the staphylococcus and B. coli survived the action of the phosphoric acid for 48 hours. Our findings in this respect do not coincide fully with those of Michaelis,[10] who found that B. coli was destroyed in 48 hours in a solution of lactic acid at a Ph of 10-4. It is not improbable that various strains of the same organism may vary in regard to their resistance to acids.

These experiments seem to justify the conclusion that the acidity of the $CO_2$ is not an important factor in the destruction of the organism. It therefore seemed probable that the high molecular concentration or the sudden change in the osmotic tension of the fluid, or possibly both, were the factors which destroyed the bacteria. $CO_2$ is very soluble in water, 0.8 of a volume being soluble for each atmospheric pressure. The maximal $CO_2$ pressure used in our experiments was 67 atmospheres, which, according to the law of the solubility of gases, would cause 52 volumes of $CO_2$ to go into solution. In order to determine the effect of this molecular tension on bacteria a solution of NaCl of corresponding concentration (7.2%) was prepared. Staphylococci and B. coli were suspended in this solution, which was acidified to a point of Ph 10-3.15, and cultures were taken hourly. It was found that these organisms were killed in about 15 hours. It does not follow, naturally, that, because the solution of $CO_2$ and sodium chlorid were of the same molecular concentration, their effect on bacteria would be identical. The effect of each on the membrane of the bacteria might be widely different; possibly the size of the molecule might be a vital factor, not to mention the possibility of the influence of incidental chemical reactions. Ignoring, for argument's sake, these unknown factors, and assuming the effect of the two solutions on bacteria to be much the same, we are led to the conclusion that the sudden release of the pressure, thereby lowering the osmotic tension of the fluid, is the vital factor in killing the bacteria, as it was found that bacteria were killed in from 1½-2½ hours in $CO_2$ solutions, whereas 15 hours were necessary to kill them in acidified salt solution of the same mole-

[10]Michaelis: Ztschr. f. Immunitätsforsch., 1912, O., 14, 170.

cular tension. The 1½-2½ hours probably represents the time required for the gas to become dissolved in the water and to diffuse thru the bacterial membranes.

The effect of hydrogen on bacteria was likewise studied. Hydrogen being only slightly soluble, it was not expected that its effect would be so marked as that of $CO_2$, its solubility being 0.01819 volumes per atmosphere. Bacteria were placed in the apparatus described in the previous experiment and attached to a hydrogen tank under pressure of 120 atmospheres. It will thus be seen that only 2.2 volumes of hydrogen could be dissolved as compared with 52 volumes of $CO_2$. Sterile cultures were never obtained under the influence of hydrogen, altho by planting the bacteria before and after treatment it was possible to demonstrate that from 10-40% of B. coli had been killed in 24 hours. There was evidence that many of the bacteria were broken up under the influence of hydrogen and this seemed in particular to be true of the tubercle bacilli. The most marked effect of hydrogen on bacteria, however, was its tendency to affect their staining reaction. Gram-positive organisms would often become gram-negative, and even the acid-fast character of the tubercle bacilli was impaired.

A study was made of the effect of hydrogen on the pathogenicity of pneumococci; it was found, however, that the pathogenicity of these organisms for white mice remained unaltered.

Nitrogen under a pressure of 120 atmospheres seemed to be entirely inert. The bacteria were not killed; neither did they present any morphologic change.

### Immunization Experiments.

As stated at the beginning, our object was to obtain the antigenic principle of bacteria in a diffused state in order to make it less accessible to the phagocytes, thereby hoping to obtain an antigen capable of producing a higher degree of immunity than is ordinarily possible with bacterial antigens. Typhoid bacilli which had been under orthostatic pressure of from 6,000-12,000 atmospheres were placed in a shaking machine for 10 hours, after which they were filtered thru a Berkefeld filter and the filtrate injected into rabbits.

The question of a standard dosage at once became a serious problem. Bacteria which had been under pressure were difficult to standardize. The following technic was therefore adopted. Six 24-hour slant agar cultures were mixed with infusorial earth and placed under pressure for 14 hours. On removal from the pressure apparatus the infusorial-earth-bacterial mixture was taken up in 50 c c of distilled water and placed on the shaking machine and later filtered. Two c c of the filtrate were then injected into the marginal ear vein of rabbits at 5-day intervals. Ten days following the third injection the agglutinating titer of the blood serum was determined. It was not uncommon to find that the serum of rabbits thus treated would agglutinate typhoid bacilli in dilutions of 1:10,000. We rarely found the titer to be below 1:5,000. Rabbits treated with living typhoid bacilli in the same manner never yielded a serum of this agglutinating titer: from 1:100 to 1:500 being the average agglutinating titer of the serum of rabbits treated in this way.

Animals were likewise immunized with bacteria and bacterial filtrate of cultures killed by $CO_2$. Altho these experiments are not yet terminated it may be said that bacteria killed by $CO_2$ give excellent results in the way of stimulating antibody formation, it being found that typhoid bacilli killed in this way gave an agglutinating serum of a higher titer than when a corresponding amount of the living culture was used. The B. coli as well as other gram-negative bacilli, it was observed, became far more toxic after having been killed by $CO_2$ than the living cultures. This is probably due to the fact that large amounts of bacterial protein were liberated by the killing process.

A few attempts to immunize with the hydrogen- treated bacteria have been undertaken. In studying the complement-fixation reaction in tuberculosis excellent results were obtained with antigens which had been disintegrated by hydrogen.

RESUME.

It has been found that a direct pressure of 6,000 atmospheres kills non-spore-forming bacteria in 14 hours. A pressure of about 12,000 atmospheres for the same length of time is required to kill spores.

Non-spore-bearing bacteria are killed by $CO_2$ of 50 atmospheres pressure in about 1½ hours. Yeast cells withstand the action of $CO_2$ for more than 24 hours, probably because of their ability to transmit the $CO_2$ molecule thru the membrane promptly.

The maximum acidity of solutions of $CO_2$ used in our experiments was Ph 10-3.15. It was shown that this degree of acidity was not a factor in killing the bacteria. A solution of sodium chlorid of a molecular concentration corresponding to a solution of $CO_2$ under 67 atmospheres and acidified to Ph 10-3.15 required 15 hours to render cultures of staphylococci and B. coli sterile. It was therefore concluded that the sudden change in the osmotic tension of the fluid in which the bacteria were suspended was the factor which destroyed the organisms.

Many of the gram-negative bacteria could be broken up by the sudden release of the $CO_2$ while the gram-positive bacteria, altho killed, suffered little or no morphologic change.

Hydrogen killed from 10-40% of B. coli. This gas had no effect on the pathogenicity of pneumococci.

The acid-fast character of the B. tuberculosis was impaired by the action of hydrogen. Hydrogen-treated tubercle bacilli yielded a suitable antigen for the complement fixation reaction.

Nitrogen under a pressure of 120 atmospheres had no effect on bacteria.

Filtrate of typhoid bacteria which had been subjected to a direct load of 6,000 atmospheres for 14 hours was found to be far superior to the living culture as an immunizing antigen. Bacteria killed by $CO_2$ were likewise found to be excellent antigens.—*The Journal of Infectious Diseases, March Issue.*

# THE JOURNAL of the NATIONAL DENTAL ASSOCIATION

Entered as second-class matter, March 22, 1915, at the Post Office at Huntington, Indiana, under the Act of August 24, 1912. Published Monthly.

Editor and General Manager.
OTTO U. KING, D. D. S., 127 N. Dearborn St., Chicago, Illinois.

Associate Editors,
THOMAS P. HINMAN, D. D. S., Atlanta, Ga.
HARVEY J. BURKHART, D. D. S., Rochester, N. Y.
THOMAS B. HARTZELL, D. M. D., M. D., Minneapolis, Minn.



All expressions of opinion and all statements of supposed facts are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the National Dental Association, unless such statements or opinions have been adopted by vote of the Association.



SUBSCRIPTION included in the annual membership dues.
SUBSCRIPTION, $2.00 a year, in advance, to non-members, living in all parts of the United States or its Possessions. Canada, $2.40. Foreign countries, $2.75. Single copies, 20 cents.
ADVERTISEMENTS accepted only from reliable firms. Fraudulent and misleading advertisements barred.
IN CHANGES OF ADDRESS both the old and new address must be given.
JOURNALS are not sent beyond the subscription period.
ORIGINAL ARTICLES, items of news and matter of interest to the profession are welcome. Request for reprints should be made at the time of forwarding articles.

VOL. 5 APRIL, 1918 NO. 4


# *Editorial Department.*

## DR. JOHN R. CALLAHAN.

## 1852-1918.

When we find the dash with the year on either side, we know the story without further words, and to you and me, of the great dental profession, earth to earth and dust to dust has been said over the body of our distinguished scientific research worker and professional brother—Dr. John R. Callahan.

Dr. Callahan was recognized as the dean of the dental profession of

Cincinnati, was a leader in the Ohio State Dental Society and a factor in the councils of the National Dental Association. He was largely instrumental in establishing a very complete Dental Department in the Cincinnati General Hospital and served as chief of its Dental Staff.

He was deeply interested in the treatment and filling of root-canals and has presented valuable contributions upon this and allied subjects. He was active in establishing the Research Institute of the National Dental Association, and for the past three years conducted researches under its grants on "Multiple Foramina;" "The Blood Supply of the Teeth and Their Supporting Structures," and "The Gross and Minute Anatomy of the Supporting Tissues of the Teeth."

At the 1915 meeting of the Ohio State Dental Society, a number of his friends presented him with a large capacity modern X-ray equipment. Later, at Atlanta, Ga., some of his southern friends presented him with additional equipment. In May, 1917, the New York State Dental Society presented him with the Jarvie Medal for scientific attainments and the following month, the Cincinnati Dental Society tendered him a complimentary dinner in recognition of this honor. These recent events are mentioned to show that his efforts were generally appreciated, altho but few of his close friends knew the extent of his sacrifices. Fortunately, these testimonials took place while he was with us and we are forcibly reminded that they were none too soon.

In the death of Dr. Callahan, the dental profession has suffered a distinct loss. He was extremely modest, decidedly methodical and always considerate of the interests of others. He presented his views in a quiet and convincing manner which readily secured an attentive audience.

Dr. Callahan was highly appreciated and respected in his home city by the dental and medical professions, and his reputation as a dental practitioner was recognized by an exclusive and appreciative clientele. His professional career was a productive one for dentistry, but unfortunately not so for himself, due to the generous sacrifices he was continuously making in behalf of the advancement of dentistry. The one consolation is that his passing was as he, his family and his friends would have undoubtedly chosen, peaceful and without suffering.

His sudden and untimely death makes it quite difficult to appreciate that his highly skilled and practical hand is forever stilled; that his trained and studious brain, with its broad vision, is no longer struggling with complicated dental problems; that his warm pulsating heart, so full of sympathy for everything connected with his chosen profession, has ceased to perform its functions; that his remarkable reserve force, which was unfortunately overtaxed on many occasions, has been finally

and completely exhausted, and that the GENIAL, CHARMING AND MAGNETIC CALLAHAN IS NO MORE.

No, Dr. Callahan is not gone; such men never die—are never lost to those who love them, and while we can no longer press his hand and see his smile of greeting, yet these are but incidents compared to the research truths and the professional advice which time itself can never efface from our minds and hearts.

---

## "SELL YOUR CHILDREN OR LET THEM DIE."

Under this ghastly but appropriate heading, the committee headed by Ignace Jan Paderewski, which is trying to raise funds for the relief of Polish victims, prints the following excerpt from a proclamation which the German rulers of Poland posted up not long ago on the walls of Warsaw:

> The government suggests that mothers having children should send them to Germany to be brought up and educated. Mothers who are willing to make this arrangement will receive the sum of 150 marks for a boy and 100 for a girl. NO OTHER AID WILL BE GIVEN.

The capitals are The Journal's. The proclamation is signed by the German governor general of Belgium.

"Sell your children, or let them starve." The grisly heading is justified.

This is Prussian kultur.

This is Hohenzollern peace.

This is the "self determination of nationalities" as understood by Von Hertling and his master.

Sell your children or let them die. No other aid will be given.

At last, kaiserism has found a way to deal with the high Polish birthrate which has troubled Teutonic statesmen so much for the last fifty years. Starve the children, or take them away and bring them up as Germans. In the country districts of Poland, starvation has been the rule; all authorities agree that there are wide areas where all the children under 7 or 8 years of age have perished. In the cities, where closer organization has kept the little ones alive, they are to be exported to Germany, trained in kultur, and made to serve, as human breeding stock or cannon fodder for the glory of the kaiser.

And still there be folks who think this war could be ended by a little conversation around a table!—*Editorial, Chicago Journal, Feb. 27.*

## PERSONNEL OF THE DENTAL CORPS.

The Personnel of the Dental Corps for the week ending March 8, 1918. The personnel of the Army included: The Dental Corps 211, Dental Reserve Corps 5114, of whom 1334 are on active duty; Dental Corps National Guard 260.

## DENTISTRY EXEMPT IN ORDER COMMANDEERING PLATINUM.

Mr. Otto U. King, Chicago, Ill.

Dear Sir: Your letter of March 12 in regard to platinum commandeering.

The effort of the War Industries Board has been to protect the essential industries using platinum and at the same time to provide platinum for the necessary Government requirements. For this purpose the control of all importations and the distribution of platinum in the hands of the importers, manufacturers and refiners was taken over by the Government. It is expected that the dentists will continue to accumulate platinum scrap and that they will make every effort to bring into the industry scrap now held in the hands of individual dentists. At the present time there is no intention of the Government taking over scrap thus accumulated, tho the Government will expect to receive a certain percentage of scrap thru various channels, and is constantly receiving offers of platinum on the part of individuals.

There is no intention of interfering with the platinum used by dental colleges or scientific institutions. It is the non-essential use of platinum the Government is endeavoring to curtail. If the present plan of cooperation is not successful, the Government may be forced to commandeer further supplies of platinum. At the present time efforts are being confined to the control of the unmanufactured platinum.

The price fixed by the Government for the importation of platinum is $105 an ounce for the platinum content in the crude platinum. It is felt that platinum scrap should not be dealt in at a price higher than $100 an ounce for the platinum content in the scrap, and should there be cases of profiteering and higher offers for platinum for non-essential purposes, the Government may be forced to commandeer stocks at the above prices.

Yours very truly,

L. L. SUMMERS,
War Industries Board.

March 20, 1918.

# Army and Navy

## THE PRACTICE OF DENTISTRY IN THE ARMY AND IN CIVIL LIFE.

**(A Comparison.)**

**By Lieut. K. F. Smith, D. R. C.**

(Read before the Camp Grant Dental Society, Feb. 15th, 1918.)

I regret that this subject so fraught with possibilities has not been placed in more capable hands than my own. I am sure that my association with army dentistry is of too recent origin to enable me to make a very comprehensive comparison and if, perchance, I wander somewhat from my subject, I ask your indulgence.

It is my belief that in choosing us from among the many dentists of this country who have volunteered their services, our country has paid us the highest compliment possible for a dentist to receive. The dentist in army service, or if I may use the term, "the army dentist" must be conscientious to the highest degree; his patients have no choice; they must accept his services, be it to their liking, or otherwise. This factor does not hold true in civil practice where the dentist who errs seriously in judgment, is rough and unnecessarily cruel, quickly loses his practice, and finds he must take up some other field of endeavor.

As army practice in cantonments, the only type of which I am qualified to speak, brings us into contact only with the male sex, usually men of a very hardy type and much authority has been placed in our hands in our relations with these men, I feel that it behooves us to watch ourselves closely, that we do not abuse this privilege and bring discredit to ourselves and dentistry in general.

We have been selected and placed in our present positions, gentlemen, with a definite object in view, to place the mouths of the men in our respective commands in the best possible shape, with as great celerity as possible. Here again we find a line of demarkation. The best possible condition, in the army parlance, differs materially from that in civil practice, estheticism must be almost entirely subordinated to the more important phases, masticatory ability, and absence of all focal infection. You will notice, gentlemen, that I qualify my statement by the word "almost." I feel that no amount of time or sacrifice is too great to make, in saving these infected teeth where the disfigurement would be marked, and our means of restoration limited, providing, of course, that the infection is ultimately curable. In all probability,

in civil life, the mere mention of drawing such a tooth would cause your patient to look elsewhere for dental treatment.

The assertion, in the army we are trying to tear down our practice and in civil life to build it up, might easily be misunderstood. In the army, it is true, that we are trying to tear down our practice by the rapid elimination of dental diseases in our commands. This principle also holds true in civil practice.

It is the successful elimination of dental diseases from our patients that enables us to increase our practice.

One marked difference that I have noted is the coolness and courage with which these men of the army face dental operation. The same class of men six months ago, in my practice, did not show the same stoicism.

I attribute it to their soldier's sense of pride, their good health and disciplinary training.

Our government has given us very complete and beautiful equipment to perform the work they wish us to do, and there is no excuse for any but the highest class of dental treatment.

This situation often confronts us, of badly broken down bicuspid or molar teeth, which in civil practice could be very nicely restored with a gold crown or possibly an inlay. These teeth should not be lost, anchorage of some kind must be secured, and the restoration made in some manner. Let us avoid, if possible, gentlemen, the accusation, in future years, "if you got a toothache in the army, they pulled it out."

I do not feel that there should be any marked difference between dentistry as practiced in the army and that of civil life, save in the limitation of our restorational material.

Good dentistry is good dentistry everywhere; the same careful consideration, tact, kindness and human interest so essential to success in civil life, will win success for dentistry in the army. For, after all, the final verdict of the success or failure of dentistry in this army is going to be read in the future years, not only in the archives at Washington, but also in the hearts and minds of some two million or more free American citizens who at present constitute, or will constitute the American Army.

## THE CLEVELAND DENTAL SOCIETY.

Cleveland, Ohio, March 19, 1918.

Dear Doctor King:

I beg to refer to the article "Dental Society Unfurls Service Flag," appearing in the last issue of The Journal.

I note with pleasure the interest that is taken by the profession in recognizing the patriotic spirit of those of our profession who have given their all to the country.

I know of no better way for the various Dental Societies to show their respect to the soldier members than to establish a Service Flag, therewith commending on the patriotism of our professional brothers.

It is with pleasure that I read your introduction to the above mentioned article for it makes me feel that the act of dedicating a Service Flag in honor of the Dentists in the Service is a worthy one and deserving mention. During the month of October, 1917, I suggested to the president, Dr. G. D. Lovett, of the Cleveland Dental Society, that the Society should have a Service Flag in honor of those members of our Society who have been called into active service, as Dental Surgeons, in the Army. His encouraging answer prompted me to order a Service Flag for our Society, and at the Council Meeting on November 5th,

1917, I displayed it for the first time, where it was adopted with enthusiasm.

The Service Flag of the Cleveland Dental Society adopted on November 5th, 1917, contained thirteen Stars representing members of the Society who at that time were in active service. They are:

Capt. C. P. Landgrebe, Camp Custer, Mich.

Capt. H. B. Wall, Camp Custer, Mich.

Lieut. W. S. Sykes, France.

Lieut. Alan MacLachlan, France.

Lieut. B. S. Rothwell, France.

Lieut. E. W. Davis, France.

Lieut. F. F. Happy, Camp Sherman, O.

Lieut. J. H. Reid, Camp Sherman, O.

Lieut. E. B. Lodge, Camp Sherman, O.

Lieut. L. W. Bentley, Camp Sherman, Ohio.

Lieut. P. J. Aufderheide, Camp Sherman, Ohio.

Lieut. W. P. Besttie, Camp Custer, Mich.

Lieut. R. M. Allen, Ft. Oglethorpe, Ga.

Today our Service Flag holds twenty Stars, the additional members being:

Lieut. B. J. Licht, Camp Sherman, O.

Lieut. L. G. Jordan, Camp Custer, Mich.

Lieut. E. Hill, Ft. Sam Houston, Texas.

Lieut. O. L. Herke, Camp Hospital, Laredo, Texas.

Private A. Bubis, Camp Sherman, O.

Lieut. E. A. Eklund, Camp Wadsworth, S. C.

Lieut. M. L. Damlos, Camp Sherman, Ohio.

Those members of the Cleveland Dental Society who have received commissions, and are still at home, are not represented on our Service Flag. They are:

E. K. Huntington, T. J. McDermott, J. W. Moats, J. L. Meikle, T. B. Roe, I. J. Silberman, S. B. Stern, H. U. Sykes, T. D. Singleton, W. W. York, C. W. Hudson, N. East, J. V. Gentilly, C. E. Briggs.

Very sincerely yours,

J. V. GENTILLY,

Secretary, Cleveland Dental Society.

## NAVAL DENTAL CORPS.

Senator Tillman's bill (S. 3749) to reorganize the dental corps of the Navy follows:

That the act approved August 29, 1916, be amended by striking out all of said act following the captions "Naval Dental Corps," "Dental Reserve Corps," and by substituting therefor the following:

"That the President of the United States is hereby authorized to appoint and commission, by and with the advice and consent of the Senate, dental officers in the Navy at the rate of one for each thousand of the total authorized number of officers and enlisted men of the Navy and Marine Corps, in the grades of assistant dental surgeon, passed assistant dental surgeon, and dental surgeon, who shall constitute the naval dental corps, and shall be a part of the medical department of the Navy. Original appointments to the naval dental corps shall be made in the grade of assistant dental surgeon with the rank of lieutenant (junior grade), and all dental officers who shall have gained or lost numbers under the provisions of the act of Congress approved August 29, 1916 (Statutes at Large volume 39, page 573), or who may hereafter be appointed, shall take rank and precedence with officers of the naval medical corps of the same rank according to the dates of their respective commissions, and dental officers shall be eligible for advancement in grade and rank in the same manner and under the same conditions as officers of the naval medical corps with or next after whom they take precedence, and shall receive

the same pay and allowances as officers of corresponding rank and length of service in the naval medical corps up to and including the rank of lieutenant commander: Provided, That dental surgeons shall be eligible for advancement in pay and allowances, but not in rank, to and including the pay and allowances of captain, subject to such examinations as the Secretary of the Navy may prescribe, except that the number of dental surgeons with the pay and allowances of captain shall not exceed four and one-half per centum and the number of dental surgeons with the pay and allowances of commander shall not exceed eight per centum of the total authorized number of dental officers. Provided further, That dental surgeons shall be eligible for advancement to the pay and allowances of commander and captain, when their total active service as dental officers in the Navy is such that if rendered as officers of the naval medical corps it would place them in the list of medical officers with the rank, pay, and allowances of commander or captain, as the case may be: And provided further, That dental officers who shall have gained or lost numbers on the Navy list shall be considered to have gained or lost service accordingly; and the time served by dental officers on active duty as acting assistant dental surgeons and assistant dental surgeons under provisions of law existing prior to the passage of this act shall be reckoned in computing the increased service pay and service for promotion of dental officers herein authorized or heretofore appointed.

"All appointees authorized by this act shall be citizens of the United States between 21 and 32 years of age, and shall be graduates of standard medical or dental colleges and trained in the several branches of dentistry, and shall, before appointment, have successfully passed mental, moral, physical, and professional examinations before medical and professional examining boards appointed by the Secretary of the Navy, and have been recommended for appointment by such boards: Provided, That hereafter no person shall be appointed as assistant surgeon in the Navy who is not a graduate of a standard medical college.

"Officers of the naval dental corps shall become eligible for retirement in the same manner and under the same conditions as now prescribed by law for officers of the naval medical corps, except, that section 1445 of the Revised Statutes of the United States shall not be applicable to dental officers, and they shall not be entitled to rank above lieutenant commander on the retired list, or to retired pay above that of captain.

"All dental officers now serving under probationary appointments shall become immediately eligible for permanent appointment under the provisions of this act, subject to the examination prescribed by the Secretary of the Navy for original appointment as dental surgeon, and may be appointed assistant dental surgeon with the rank of lieutenant (junior grade) to rank from the date of their probationary appointments: Provided, That the senior dental officers now at the United States Naval Academy shall not be displaced by the provisions of this act, and he shall hereafter have the grade of passed assistant dental surgeon and the rank, pay, and allowances of lieutenant, and he shall not be eligible for retirement before he has reached the age of seventy years, except for physical disability incurred in the line of duty: Provided further, That no dental officer in the Navy who on original appointment as dental officer was over forty years of age shall be eligible for retirement before he has reached the age of seventy years, except for physical disability incurred in line of duty.

"All acts or parts of acts inconsistent with the provisions of this act are hereby repealed: Provided, That nothing herein shall be construed to reduce the rank, pay, or allowances now authorized by law for any officer of the Navy."—*Army and Navy Register, March 2, 1918.*

## INFORMATION REGARDING SICK SOLDIERS.

Orders will shortly be issued from the War Department instructing commanding officers and medical officers to inform the next of kin in the case of soldiers who are critically ill in hospitals. There has been a great deal of complaint from members of Congress who have heard from parents and friends of men in the service that the military authorities have refused or have failed to give this information, even when requested, in urgent appeals by those most profoundly interested. Since the beginning of the war there has been observed by Army officers the provisions of the regulations against furnishing information "which can be made the basis of a claim against the Government." Exception is taken to this occasion of refusal, because it is regarded at the capitol by congressional critics as having less concern for the anxiety of soldiers' relatives than for the interest of the Government in a direction that is not likely to be injured. Perhaps the fact that officers have been busy in the performance of extraordinary duties and demands upon their time, accounts for a large part of the failure to reply to inquiries in regard to the condition of soldiers who are under treatment in hospitals; at all events, the circumstance has led to a protest to the War Department with the result that instructions will be issued which will insure the giving out of information concerning sick and wounded officers and enlisted men of the Army, "freely conveyed to allay the anxiety of friends."—*Army and Navy Register, February 16.*

## VACANCIES IN ARMY MEDICAL CORPS.

Representative Dyer has introduced the following bill (H. R. 9750):

That hereafter the President shall be authorized to fill any vacancies that may occur in the commissioned personnel of the medical department of the Army of the United States by ordering such officers of the medical section, officers' reserve corps, who shall have been in active service one year or more, to the Army Medical School under such rules and regulations as shall be prescribed by the Secretary of War, and such officers so ordered, upon completion and satisfactory examination, shall be commissioned first lieutenants in the medical corps, United States Army, and be entitled to all the pay, promotion, and allowances of officers of like rank in the Army of the United States, except that the rate of retirement shall be one-thirtieth of the present retirement pay as now prescribed by law for each year's active service as an enlisted man, contract surgeon, or as a commissioned officer in the Army of the United States, medical section officers' reserve corps, medical reserve corps or organized militia in Federal service: Provided, That at the age now prescribed by law for retirement, every officer to be so commissioned shall have had not less than fifteen years' active service in any of the branches enumerated in this act: Provided further, That preference for appointment shall be given to those who have had the longest aggregate active service in the branches enumerated in this act.—*Army and Navy Register, Feb. 16.*

# ORGANIZATION OF THE OFFICE OF THE SURGEON-GENERAL, U. S. ARMY.*

The following outline gives the personnel of the divisions of the Surgeon-General's Office as shown in the chart on the opposite page: The sections should be read in conjunction with the chart, reading left to right.

**Surgeon-General United States Army.**—Major-General W. C. Gorgas; **Attaches:** Col. C. K. Morgan, British Army; Col. C. U. Dercle, French Army; Lieut.-Col. C. L. Furbush.

**Chief Assistants to the Surgeon-General.**—Brig.-Gen. Charles Richard; Brig.-Gen. Henry P. Birmingham; Col. James W. Van Dusen; Col. James R. Church.

**Administration.**—Major J. L. Gooch, Jr.; Lieuts. C. H. Wilson; S. P. Davies, L. J. Wyeth, Bernard Gumprecht.

**Personnel.**—Cols. Robert E. Noble, R. B. Miller, Lieut.-Col. Bert W. Caldwell; Majors Horace D. Arnold, M. R. C.; John S. Coulter, William H. Walsh, M. R. C.; Charles W. Ayres; Captains F. C. Waite, John H. Rose, M. R. C.; Robert F. Miller, John E. Horn; Lieuts. Henry L. Mann, L. B. Schutte.

**Finance and Supply.**—Cols. Carl. R. Darnall; Edwin P. Wolfe; Majors E. R. Gentry, E. C. Jones, J. C. King, D. S. White, V. C.; W. T. Fishleigh; R. A. Wood; Capts. J. B. Copping, A. L. McMurtry, W. G. Stoner, J. C. Scheve, F. W. Lennox, D. M. MacClaire, J. G. Moon, V. C., N. A.; Lieuts. E. P. Turner, J. Van Putten, H. Kelley, E. Thompson, M. B. Bradley.

**Sanitation.**—Cols. Deane C. Howard, P. M. Ashburn, W. P. Chamberlain, J. W. White; Lieut.-Cols. F. W. Weed, V. C. Vaughan, W. D. Wrightson; Majors E. D. Kremers, James T. B. Bowles; Capts. H. N. Fuller, E. J. Tucker; Lieuts. E. E. Hume, T. R. Kendall. **Medical Section (Division of Sanitation) Sick and Wounded Records and Bureau of Information.**—Lieut.-Col. Albert G. Love; Capt. Robert H. Delafield.

**Training Camps.**—Col. Edward L. Munson.

**Ambulance Service.**—Brig.-Gen. Henry P. Birmingham; Capts. Luke C. Doyle, J. F. Newport.

**Hospitals.**—Col. Robert E. Noble; Lieut.-Cols. Charles F. Morse, L. J. Owen, H. H. Johnson, W. L. Hart, W. H. Smith; Majors Floyd Kramer, C. L. Brown; Louis B. Baldwin, M. R. C.; Capts. Clifford Perry; Lieut. Jens Christensen.

**Special Hospitals and Physical Reconstruction.**—Lieut.-Col. Edgar King; Majors James Bordley, M. R. C.; H. E. Mock, M. R. C.; R. H. Hutchings, M. R. C.; Paul B. Magnusen, M. R. C.; Casey A. Wood, M. R. C.; M. E. Hagerty, M. R. C.; H. B. Price, W. H. Henderson, M. Murray, A. C. Monahan; Capts. C. Burns Craig, M. R. C.; A. H. Samuels; Lieuts. William J. Ezickson, M. R. C.; W. A. Clark, M. R. C.; Charles Willing, John T. Boyd.

**Surgery.**—Col. W. H. Moncrief; Majors R. P. Sullivan, M. R. C.; A. B. Kanavel, M. R. C.; S. H. Smith, P. R. Turnure, M. R. C.; M. G. Seelig, M. R. C.; F. W. Bailey, M. R. C.; Lieuts. P. E. McNabb, T. P. Davison, H. I. Wilson.

**Military Orthopedic Surgery.**—Lieut.-Col. E. G. Brackett; Majors David Silver, M. R. C.; Henry R. Hayes, M. R.; Paul B. Magnusen, M. R. C.; A. S. Begg, M. R. C.; J. T. Rugh, M. R. C.; Kendall Emerson, M. R. C.; Capts. S. D. Breckenridge, M. R. C.; Horace Morison, John H. Morse, M. R. C.

**Urology.—Genito-Urinary Diseases:** Dr. G. W. Wende; Capt. Warren Walker, M. R. C.; **Venereal Diseases:** Majors William F. Snow, M. R. C.; W. A. Sawyer, M. R. C.; Capts. A. N. Thompson, M. R. C.; A. B. Spingarn; Lieut. Sidney F. Morgan.

**Head Surgery.**—Col. T. C. Lyster; Lieut.-Col. W. H. Parker, M. C., N. A.; Majors N. M. Black, M. R. C.; H. P. Mosher, M. R. C.; V. P. Blair, M. R. C.; Allen Greenwood, M. R. C.; C. W. Richardson, M. R. C.; Charles Bagley, Jr., M. R. C.; R. H. Ivy, M. R. C.; Capt. H. H. Kerr, M. R. C.

**Roentgenology.**—Lieut.-Col. A. C. Christie.

**General Medicine.**—Col. George E. Bushnell. **Gastro-Intestinal.**—Major Seale Harris, M. R. C.

**Tuberculosis.**—Lieut. Col. E. H. Burns; Capt. W. H. Phares, S. C., N. A.

**Cardiovascular.**—Lieut.-Col. Warfield T. Longcope; Major A. E. Cohn, M. R. C.; Lieut. F. C. McLean, M. R. C.

**Psychiatric.**—Lieut.-Col. Pearce Bailey; Capt. Sanger Brown, 3d, M. R. C.; Lieut. Roy Haber.

**Psychology.**—Majors R. M. Yerkes, K. T. Waugh; Capt. C. S. Berry; Lieut. A. S. Otis.

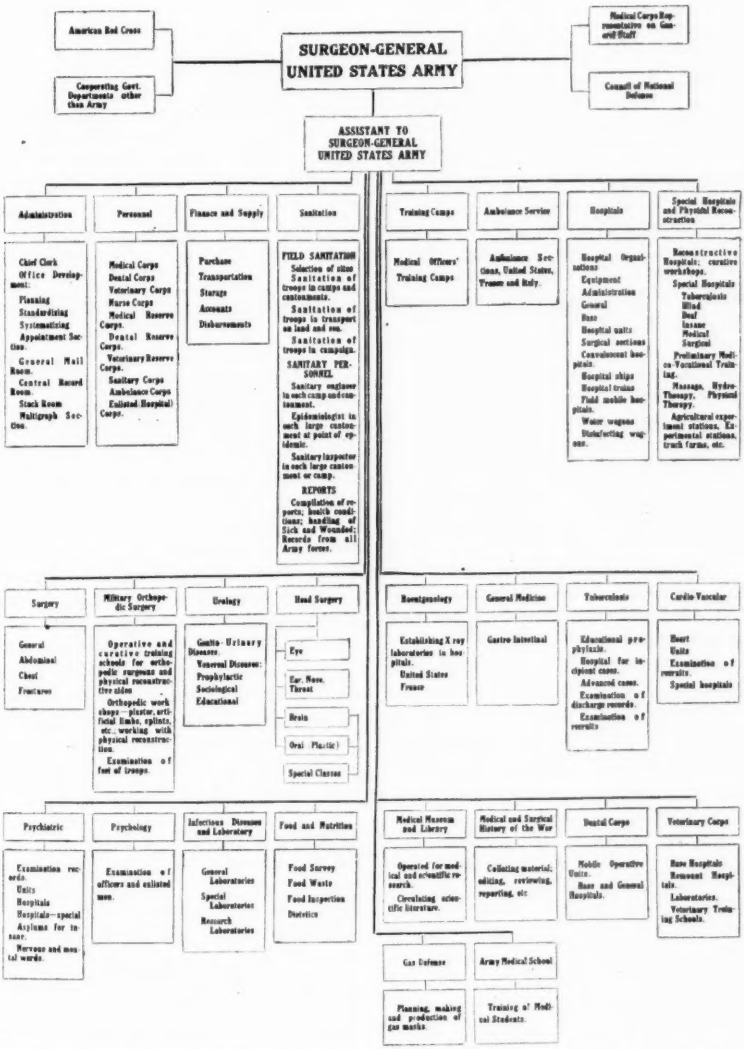
**Infectious Diseases and Laboratory.**—Col. F. F. Russell; Majors H. J. Nichols, E. K. Dunham, M. R. C.; George Draper, M. R. C.; Capt. J. B. Murphy; Lieut. Harry A. Mankin.

**Food and Nutrition.**—Majors John R. Murlin; Casper W. Miller, M. R. C.; Capt. W. P. Garrety; Lieut. F. M. Hildebrandt.

**Gas Defense.**—Brig.-Gen. Henry P. Birmingham; Lieut.-Col. Bradley Dewey; Major Arthur L. Besse; Capts. L. E. Cover, Frederick A. Dewey, Francis J. Eiseman, M. R. C.; Paul V. Hollenbeck, O. R. Johnson, William S. McKinney, James D. Pilcher, M. R. C.; James H. Walton; J. W. Wheeler; John O. Woodruff; Lieut. J. Stanley Babbitt; Joseph J. Barnett.

**Army Medical School.**—Brig.-Gen. William H.

*Reprint from American Medical Journal, March 9, 1918.




ORGANIZATION OF THE OFFICE OF THE SURGEON-GENERAL, UNITED STATES ARMY, 1918

Arthur; Lieut.-Cols. E. R. Whitmore, E. B. Vedder, H. W. Jones; Major C. G. Snow.

**Medical Museum and Library.**—Curator: Col. W. O. Owen. **Librarian:** Col. C. C. McCulloch, Jr.

**Medical and Surgical History of the War.**—Majors F. H. Garrison, M. R. C.; John S. Fulton, M. R. C.; Lieut. C. T. Crudgington.

**Dental Corps.**—Lieut.-Cols. W. H. G. Logan, J. R. Ames, D. C.; Lieuts. J. F. Doyle, J. E. Schaefer.

**Verterinary Corps.**—Col. R. B. Miller; Lieut.-Cols. C. J. Marshall, V. C., N. A.; C. F. Morse; Major R. S. Stanclift, V. C., N. A.; Capt. J. N. Hornbaker, V. C., N. A.

The following divisions are not indicated on the chart:

**Army Nurse Corps.**—Miss Dora E. Thompson; Miss A. W. Goodrich, Field Inspector of Nurses; Miss F. M. Durkin; Miss Edith A. Mury.

**Active Vocational Board.**—Dr. Royal Meeker, labor; Dr. Davis Edsall, medico-vocation; Mr. John E. Wilder, industrial and employment; Mr. Charles A. Stone, industrial and employment; Dr. Dean Lewis, general surgeon; Mr. Douglas C. McMurtrie.

**Reconstructive Aides.**—Miss Margurite Sanderson.

## MEDICAL CORPS COMMISSIONS.

Something of a muddle has resulted from conflicting decisions regarding the authorized enlisted strength of the Regular Army as a basis for determining the number of officers allowed the medical corps and dental corps, section 10 of the national defense act of June 3, 1916, providing that "the total number of such officers shall approximately be equal to, but not exceed, except as hereinafter provided, seven for every one thousand of the total enlisted strength of the Regular Army authorized from time to time by law" and also authorizing the appointment of dental surgeons "at the rate of one for each one thousand enlisted men of the line of the Army." By one decision a strength of approximately 300,000 was used as a basis for determining the allowance of officers of the medical corps; the numbers in the several grades were adjusted on this basis, and some officers were nominated, confirmed, and commissioned in higher grades on this basis. It was claimed in behalf of the medical officers that the temporary strength prescribed from time to time for the signal corps in accordance with the aviation act of July 24, 1917, should be included in computing the strength of the Regular Army for determining the allowance of officers of the medical corps, and that a strength of approximately 450,000 should be used at this time as a basis. The matter was reconsidered by the judge advocate general of the Army and by the general staff, and now it has been decided that the temporary strength of the signal corps and some other factors proposed by the surgeon general's office should not be included and that the number of officers of the medical corps should be determined on a basis of about 213,000 enlisted men. With a computation of the allowance on the latter basis, it is found that the number of medical officers commissioned in higher grades exceeds the allowance. It becomes at once a question what may be done in the cases of these excess officers. The commissions having been issued after confirmation by the Senate they can not now be recalled, and naturally the officers affected are reluctant to surrender them. So far as it has been determined, it probably will be necessary to carry them in these grades as supernumeraries to be absorbed later as vacancies occur. While the decision does not affect the dental officers to such an extent as the medical officers, for the reason that it is prescribed that their numbers shall be based on the number of enlisted men in the "line" of the Army, it does affect indirectly a determination of their allowance, but so far no excess commissions in higher grades have been issued.—*Army and Navy Register, March 2.*

## MEDICAL DEPARTMENT TRAINING.

The first class of dental officers to be sent to the medical officers' training camp at Fort Oglesthorpe, Ga., will commence the course of instruction March 15. The courses will last for two months. During the first month about 180 hours will be devoted to general military subjects and during the second month about 71 hours to these subjects and 100 hours to special dental subjects. The military staff already at the training camp will conduct the military instruction. Lieutenant Colonel John H. Snapp, dental corps, has been relieved from duty at Camp Upton, N. Y., and assigned to duty as senior dental instructor at Fort Oglethorpe. He will be assisted by several members of the dental corps and by a staff of members of the dental reserve corps who have had experience, before entering the military service, as special instructors at dental colleges. It is planned to send to the camp each month a class of about 85 dentists, of whom all that can be spared from their present duties will be recent appointees to the dental corps, with a sufficient number from the dental reserve corps to make up the prescribed number. Preparations are being made for erection of special buildings for use in conducting the instruction in dental subjects. Plans for a general enlargement of the scope of training various classes of the personnel of the medical department at Fort Oglethorpe are awaiting approval. Besides the dentists, commissioned and enlisted members of the sanitary corps and veterinary corps also are to be put thru special courses of instruction pertaining to their special work, some members of the sanitary corps already having been sent there. At present there are about 1,500 officers and 9,000 enlisted men of the medical department at the camp. A similar camp has been conducted at Fort Riley, Kas., where there are about 1,000 officers and 6,500 enlisted men. While it is not intended to discontinue the Fort Riley establishment immediately the plans that are being made contemplate a gradual enlargement of the facilities and scope of work at Fort Oglethorpe to the end that the educational system of the medical department, so far as it may be conducted at a training camp, eventually will be concentrated at that place, with a corresponding diminution at other places.—*Army and Navy Register, March 2, 1918.*

## WAKE UP, AMERICA.

The indisputable fact that offensive pro-German sentiment exists and is openly expressed in one of our northwest states by naturalized citizens in possession of the acquired privilege of suffrage should lead this government to take unhesitating steps to prohibit the exercise of suffrage to all such proven passive traitors to the land that received them and extends to them the privileges enjoyed by our native-born. And this prohibition should never be withdrawn. This war has given them the opportunity to show us whether they are for or against us, and they have chosen to be against us. These ingrates but too plainly show that they were drawn to this country, not by appreciation of its liberal institutions, but only by their appreciation of the extraordinary opportunities which we give them for personal gain and which are denied to the poor of their own countries.

The day has come when the pro-Ger-

man, the pro-Austrian, the pro-Hungarian, the pro-Turk, and the pro-Bulgar must silence his traitorous mouthings or meet the wrath of the all-American.

Why should these people who are agianst us, be considered politically as of us at all? So wedded are some of these northwest people to the land of their birth that in the land of their adoption (for gain only) they publish newspapers in their native tongue, thus furnished evidence that they are still not of us, tho they and their offspring share equally with the native-born in the benefits of our democratic institutions. Americans are, and have always been, too generous with the things that go with their own birthplace. They have thru thoughtlessness freely put political power in the hands of thousands of unworthy and unsympathetic citizens of foreign birth, and this war has shown the folly of it as well as the risk of it. Let us get together and scotch these vipers in the northwest or elsewhere they may be found.

The plain people whose sons and relatives are at the front fighting for the perpetuation of government by the people will have to teach them the unforgetable lesson. The politician who will accept office without inquiring by whose votes he may be elected need never be expected to assist in the punishment of these traitors to the state. Let the watchword as to them be either death or deportion to the land of their birth, and if necessary let force be used to drive them to a speedy decision regarding which alternative they will choose. Let us do honor to those naturalized Americans whose words and deeds prove that they are unreservedly of us, and let us do violence to those who are not.

We must either do it now or be driven to it later. It is the part of an obvious mission to do it now. At the beginning of this war the lethargy of England was aroused by the cry: "Wake up, England." She is now awake.

**Wake up, America.**

One-half of you are "asleep at the throttle." Destroy at once the traitorous clans that have implanted themselves within your confines by driving them beyond your borders.—*Army and Navy Register, February 16, 1918.*

## MEDICAL STUDENTS COMMISSIONED.

Under a recent arrangement between the Navy and War Departments, the privilege has been extended to enrolled medical and dental students to accept commissions in the medical corps of either branch of the service. The privilege applies to either the Army or the Navy; that is, an enrolled medical student of the naval reserve force may accept a commission in the medical reserve corps of the Army, and vice versa. To be relieved however, of his obligation as an enrolled enlisted man, he must accept active duty; for no enrolled students will be disenrolled in order to accept a commission in the inactive reserve in the other branch of the service. The operations of the selective draft law had the effect of greatly increasing the number of enrollments of medical and dental students, particularly in the naval reserve force. These men will be permitted to pursue their course of instruction until they graduate, when they will probably be called to active duty and instruction in hospitals and at training stations. It is not expected that under-graduates will be assigned to active duty during their vacation period.—*Army and Navy Register, February 23.*

## MEDICAL CORPS PERSONNEL.

Representative Dyer, on Saturday in the House, called attention to rank for officers of the Medical Department of the Army. Among other things, he said:

"One of the greatest drawbacks to genuine efficiency in the Medical Department of the Army is the lack of rank for officers of the Medical Corps and the Medical Reserve Corps. There is now a bill pending before the Committee on Military Affairs of the House to remedy this condition. According to the present law the ranks for officers in the Medical Reserve Corps are first lieutenant, captain, and major. Legislation now pending provides for ranks in addition to the ones mentioned, of lieutenant colonel, colonel, brigadier general, and major general. There is a genuine demand from the medical profession of the country for a law that will permit promotions along the lines indicated in this bill on account of the great value it will be to the health and welfare of soldiers. A recommendation involving the efficiency of the Army, because health is necessary to efficiency, given by a medical officer to a line officer of superior rank fails to carry weight necessary for such an important recommendation. This has been the experience of many officers in the past and has been responsible for this demand for advanced rank. The number in the Regular Medical Corps now on active duty is 775. Volunteer physicians in the Medical Officers' Reserve Corps to the number of 12,855 are now on active duty. As you well know, physicians of the highest standing in the profession are now in the military service with the rank of major, the Army, therefore, losing the benefit of their experience and knowledge because of a lack of power to enforce their recommendations. Advanced rank carries with it this power."

The executive committee of the General Medical Board of the Council of National Defense has unanimously recommended the enactment of the proposed legislation which provides that the commissioned officers of the Medical Corps and of the Medical Reserve Corps of the Army on active duty shall be distributed in the several grades in the same ratios heretofore established by law in the Medical Corps of the United States Navy.

The Surgeons General shall also have authority to designate as "consultants" officers of either corps and relieve them as the interests of the service may require.

—*Army and Navy Register.*

## SURGEON GENERAL BRAISTED REAPPOINTED.

Secretary Daniels, announcing that the President has sent to the senate the reappointment of Rear Admiral William C. Braisted as surgeon general of the Navy, made the following statement:

"Surgeon General Braisted is so efficient and capable and the bureau of medicine and surgery under his direction has made such an excellent record under the conditions imposed by the war, that his reappointment will meet with general approval.

"During the past year the medical corps has grown from a personnel of 320 to 1,950. The hospital corps has increased from about 1,600 to over 8,000; the dental corps from 30 to 308, and the Navy nurse corps from 140 to 850; most of this increase having been, of course, since we entered the war. A division of

sanitation has been established to which have been assigned a number of the ablest officers of the United States Public Health Service, and the work of this new division has proved of great value. Four hospital corps schools have been established in connection with the work of the training stations at Newport, R. I.; Great Lakes, Ill.; Hampton Roads, Va.; and San Francisco Cal.

"The large and rapid growth in the Navy's personnel imposed unprecedented burdens upon the medical corps, and necessitated a corresponding enlargement of our hospital facilities which have increased from 2,000 to 8,000 beds, with further increases provided for. The standardized units adopted for temporary construction and the policy of detention and segregation have proved notably successful in the prevention and eradication of disease in training camps. In spite of outbreaks of communicable disease that are inevitable when large numbers of recruits are gathered in camps, the health of the Navy, as a whole, has been remarkably good, and this is, in a large measure due to the excellent work of the medical corps. Every demand on the corps has been promptly and efficiently met.

"Two more hospital ships have been added to the Navy by the acquirement and conversion of the Havana and the Saratoga, which are well adopted to the purpose and have been equipped with operating rooms, laboratories, diet kitchens, and everything needed. The Navy is building at Philadelphia the first naval vessel ever constructed from the keel up for a hospital ship. This will be, the authorities state, the finest hospital ship in existence, a model of its kind.

"Tho we have been at war for 10 months and for a year have been operating under practically war conditions, the total number of deaths in the Navy, with a personnel of approximately 300,000 was less than 1,000 during 1917, including drownings and all other casualties.

"The health of the Navy is reported as unusually satisfactory for this time of year and has shown a marked improvement in the past month.

"Surgeon General Braisted keeps in daily touch with sanitary and health conditions ashore and afloat, and the gratifying experience of the Navy as to the health of its personnel is largely due to his foresight and leadership, combined with the complete co-operation of all in the medical corps."—*Army and Navy Register, February 16.*

## BILL FOR NAVY NURSE CORPS.

Under date of February 1, Representative Hicks of New York introduced a bill to prescribe the personnel of the Navy Nurse Corps, method of appointment, etc. The bill provides, in brief, that the Nurse Corps (female) of the Medical Department of the Navy shall hereafter be known as the Navy Nurse Corps, and shall consist of one superintendent and as many chief nurses and research nurses as may be needed. The superintendent shall be appointed by the Secretary of the Navy and all other members by the Surgeon-General, by and with the approval of the Secretary of the Navy. The chief nurses are to be appointed by promotion from the other members. The annual rate of pay to be: for the superintendent, $2,400; for the nurses, $840, with increases for each three-year period; and for the chief nurses, $360, in addition to the pay of a nurse. All members shall receive $10

per month additional when serving outside the United States. There are also provisions for retirement pay, leave of absence, transportation and subsistence, and a final provision repealing previous regulations covering these points.

# DENTAL CORPS ORDERS FROM WAR DEPARTMENT.

## DENTAL RESERVE CORPS.

Promotions of following named lieutenants to grade of major announced: Archibald L. Miller, Albert Mehrer, Walter H. Richardson, Grove W. Dunham, Sherman M. Fowler, Donald D. Cornell, Ernest O. Lawding and John Voss.

Appointment of following to grade of captain announced: 1st Lieuts. Edwin H. Smith, Charles W. Swing, Philip H. Woods, Walter E. Lotz, Wm. G. Buchanan, Wm. W. Peebles, James E. Johnson, Theron J. Hickey, George A. Withrow, James T. Cannon, Walter LeR. Wilson, Victor I. Buss, Floyd E. West, Wm. R. Cashin, Arthur A. Hoffman, Albert W. Anderson, Wm. E. Boyle, Edgar T. Blocher, George H. Elliott, Charles H. Masters, Charles A. McDermand, Frank R. Woods, James W. Ferguson, DeWilton H. Milstead, Jesse J. Corlew, John F. Clark, Edward F. Lafitte, Edwin C. Baker, Louis A. Haffner, Louis H. Caderette, Joseph A. Corriveau.

George V. Cannon, Wm. M. Bergan, Irving P. Carr, James E. Cox, George N. Abbott, David S. Bedrick, Wilbur, A. Charron, Wm. L. Davidson, Wm. P. Delafield, Wm. A. Walzem, Milton H. Anderson, Walter Sorenson, Charles J. Meyer, Thomas J. Guilfoil, James H. Keith, Walter Grandage, Thomas E. Power, Frederick W. Day, Wm. B. Cobb, John J. Lally, Frank L. Hardy, Wm. R. Beattie, Sperry B. Claypool, Roy A. Stout, Albert E. Thornberry, Shubael C. Stratton, Albert W. Farley, Warren E. Guerrier, Cornelius Locke, Harrison B. Wall, Clarence P. Landgrebe, Oakley B. Davy, Max C. Frazier, Charles F. Huber, Claude L. Hunsicker, James W. McGuire, Thomas L. Rice and Stanton L. Sherman.

—*Army and Navy Register, issue March 2, 1918.*

Appointment (promotion) of 1st Lieut. Joseph D. Eby to grade of major announced.

Capt. Cornelius Locke to Panama Canal Department for duty.

Appointment of following-named lieutenants to grade of captain announced: Daniel T. Bowers, David G. Everhart, Melvin M. Augenstein, Wm. O. Boss, Fred Tiesse, Jr., John C. McElhaney; Wm. B. Noble, Denzil C. Barnhill, Ernest E. Boyd, Albert L. Bruener, Walter T. Clark and Gordon L. Ross.

Appointment of 1st Lieuts. Oscar Le Roy Whitson, Ernest Eugene Buell, Harry Paulus Bachman, and Wilbert J. Scruton to grade of major announced.

—*Army and Navy Register, issue March 9, 1918.*

Appointment (promotion) of following first lieutenants to grade of major announced: Joseph A. Boarts and John McD. Eveleth.

—*Army and Navy Register, issue March 16, 1918.*

Capt. Fred Tiesse, Jr., to Washington, 50th infantry camp, East Potomac Park, for duty.

The following to Fort Oglethorpe for course of instruction: Capt. Floyd E. West, 1st Lieuts. Guy P. Bannister, Wm. R. Beattie, Albert J. T. Beatty, Francis A. Boylan, Wm. Z. Carroll, Walter T. Clark, John F. Connolly, Donald D. Cornell, Thomas Crenshaw, Jr., James G. Crutchfield, Charles E. Davis, Joseph D. Eby, George H. Elliot, Max C. Frazier Walton J. Graft, James F. Hannon, Edger T. Haynes, James H. Keith, Floyd D. Leach, Edward B. Lodge, Jerome B. Marshall, Walter F. Neuhoff, Arthur H. Nobbs, Henry W. Rich, George E. Roland, Wm. J. Stark, Roy A Stout, Wm. V. Thomson, Harry M. Trafford, Raymond L. White and Walter L. Wilson.

—*Army and Navy Register, issue March 23, 1918.*

## DENTAL CORPS.

1st Lieut. Glover Johns from duty at Camp MacArthur, Tex., to Fort Sam Houston for duty.

1st Lieut. Joseph E. Schaefer from duty at Camp Meade, Md., to surgeon general's office for temporary duty.

The following to Philadelphia, School of Plastic and Oral Surgery, Evans Dental Institute, for instruction and return to proper station; 1st Lieuts. Wm. J. R. Akeroyd, Frederick C. Daniels and Julius L. Bischof.

The following upon arrival in United States to Washington for examination for promotion: Majs. Charles C. Mann and Arthur J. Skillman, and Maj. Mann to Columbus Barracks for duty and Maj. Skullman to Camp Upton, N. Y., 77th division, for duty.

—*Army and Navy Register, issue Feb. 16, 1918.*

The following appointments in dental corps announced: To be first lieutenants, 1st Lieut. John G. Urban, dental reserve corps; Carl S. Emert, of Indiana; 1st Lieut. Wm. H. Siefert, dental reserve corps; Samuel J. Lewis, of Michigan; 1st Lieut. James H. O'Reilly, dental reserve corps; Frederick W. Miller, of Missouri; James A. Curtis, Jr., of Georgia; 1st Lieut. James J. Weeks, dental reserve corps; John N. White, of Kentucky; 1st Lieut. Homer L. Sams, dental reserve corps; George M. Krough, of Minnesota; 1st Lieut. Wayne W. Wolley, dental reserve corps; 1st Lieut. Edward W.

Barr, dental reserve corps; 1st Lieut. Ferdinando E. Rodriguez, dental reserve corps; 1st Lieut. John L. Davis, dental reserve corps; 1st Lieut. Joseph H. Jaffer, dental reserve corps; Adolph A. Meyer, of California; 1st Lieut Howard C. Feyler, dental reserve corps; Wm. F. Scheumann, of Indiana; 1st Lieut. Alonzo G. McCue, Jr., dental reserve corps; Campbell H. Glascock, of Missouri; 1st Lieut. Austin F. Roberts, dental reserve corps; Wm. F. Wieck, of Texas; Thomas H. Veale, of Massachusetts; 1st Lieut. Lawrence J. Dunn, dental reserve corps; Carl R. Oman, of Washington; 1st Lieut. Leslie A. Gould, dental reserve corps, and Harold A. Curtis, of New York.

Maj. Arthur J. Skillman to Chillicothe, Ohio, Camp Sherman, for duty.

*—Army and Navy Register, issue Feb. 23, 1918.*

Lieut. Col. John H. Snapp from duty at Camp Upton, N. Y., to Fort Oglethorpe, medical officers' training comp, for duty as senior dental instructor.

*—Army and Navy Register, issue March 2, 1918.*

Leave for three months on surgeon's certificate granted Lieut. Col. Raymond E. Ingalls.

*—Army and Navy Register, issue March 9, 1918.*

Lieut. Col. George E. Stallman (promoted subject to examination) having been examined for promotion and found physically disqualified for duties of lieutenant colonel in dental corps by reason of disability incident to service, his retirement as a lieutenant colonel is announced. He will proceed to his home.

Maj. Arthur J. Skillman to Camp Sherman, O., for duty in base hospital.

1st Lieut. Julius L. Bischof from Evans Dental Institute, Philadelphia, to Camp Joseph E. Johnston, Fla., for temporary duty in base hospital.

The following to Fort Oglethorpe, medical officers' training camp, for duty: 1st Lieuts. Wm. F. Scheumann and John N. White.

The following to Fort Oglethorpe, medical officers' training camp, for course of instruction: 1st Lieuts. Harold A. Curtis, Lawrence J. Dunn, Carl R. Oman, John L. Richards, Thomas H. Veale and Carl S. Emmer.

*—Army and Navy Register, issue March 16, 1918.*

Maj. Richard B. Clark from duty in Hawaiian Department to San Francisco.

The following from present duties to Fort Oglethorpe for duty as instructors: Majs. Ben. H. Sherman and E. Henry Valentine.

The following to Fort Oglethorpe for course of instruction: Maj. Thomas L. Smith, 1st Lieuts. Alvin E. Anthony, Leslie D. Baskin, Jacob L. Brause, Arthur T. Burchill, Albert S. Cumming, Frederick C. Daniels, Alvin D. Danheisser, Benjamin H. Dean, James E. Dean, Chester Denham, Melvin R. Eiche, Harold S. Embree, Raymond H. Fisher, Jerome L. Fritsche, Dell S. Gray, Leroy P. Hartley, William H. Hoblitzel, Henry L. Hogan, Avery G. Holmes, Clarence R. Jacobson, George R. Kennebeck, Hooker O. Lindsey, Lewis W. Maly, James B. Manning, Neil J. McCollum, Roy R. Newman, James H. O'Reilly, Harold J. Parker, Adrian C. Ragan, Fletcher D. Rhodes, Fernando T. Rodriguez, Walter A. Rose, John A. Rowe, Roy C. Starr, Eugene A. Smith, Wm. B. Stewart, Robert L. Strickland, Richard F. Thompson, Lynn H. Tingay and Walter D. Vail.

*—Army and Navy Register, issue March 23, 1918.*

## MEDICAL CORPS, NATIONAL ARMY.

Brig. Gen. Henry P. Birmingham from duty in office of surgeon general to Fort Riley for purpose of making inspection of medical officers' training camp and to Fort Oglesthorpe for duty as commandant, medical officers' training camp.

Lieut. Col. Wm. S. Terriberry, Fishers Island, N. Y., to Newport News, Va., for duty as commanding officer of base hospital.

*—Army and Navy Register, issue March 16, 1918.*

## FIXING GRADES IN MEDICAL CORPS.

Senator Owen proposes to amend the pending bill (S. 3748) fixing the grades of the commissioned officers of the medical corps and of the medical reserve corps of the United States Army on active duty by adding the following:

"Nothing in this act shall be construed to deprive any officer of the medical corps of the United States Army of a commission he now holds."—*Army and Navy Register, March 2.*

# Universal Military Training

## WAR NEED OF UNIVERSAL TRAINING.

It must be apparent to every intelligent American by this time that the nation is engaged in no limited liability war. It is a war of desperation. It must be fought to a successful end, even tho in so fighting the nation be compelled to use its last available man and its last available dollar. The war must be fought, therefore, with the greatest possible efficiency and the greatest possible determination.

Those earnest men who insist that there should be no further delay in enacting a law establishing a system of universal military training now find themselves confronted by a newly devised argument in the mouths of the same government officials who formerly denounced the proposed system as shockingly militaristic. These officials say that to train boys of 19 in soldierly tasks would interfere with the training of soldiers for the serious business of fighting the war, that there are no army officers to spare for the work, and so on. This is mere evasion. No intelligent advocate of universal military training desires any application of the system that would interfere for an instant with the task of fighting the war. On the contrary, friends of that system urge its adoption at this time as an exceedingly valuable war measure.

Hundreds of thousands of young men have been registered as eligible and available for war service. Other hundreds of thousands who have reached the age of 21 since the registration last June presumably will be registered soon. But Germany has made no promise to consider itself defeated and to sue for peace as soon as these men get under arms and go into battle. The American armies must continue to grow in size as long as the war lasts. The time may come long before the end of the war when universal military training of American boys of 19 will be an essential part of the task of putting soldiers into the field to fight the forces of autocracy. When that time arrives the law authorizing such training should be ready to serve the nation's need.

Pass the universal military training bill now as a war measure and also as a measure of enormous benefit in time of peace. The Washington practice of conjuring up imaginary objections to universal training is wholly evil. It discloses latent pacifism. It is a symptom of the old pacifist fear that we shall hit the enemy too hard, or at least that we shall adopt a too efficient system of permanent national defense.

## THE CRIMES OF GERMANY.

"I was and am proud of the great inheritance which came to me as a birthright and of the illustrious contributions which the German people have made to the imperishable assets of the world. Until the outbreak of the war in 1914, I maintained close and active personal and business relations in Germany. I was well acquainted with a number of the leading personages of the country. I served in the German army thirty years ago. I took an active interest in furthering German art in America. I do not apologize for, nor am I ashamed of my German birth. But I am ashamed—bitterly and grievously ashamed—of the Germany which stands convicted before the high tribunal of the world's public opinion of having planned and willed war; of the revolting deeds committed in Belgium and northern France; of the infamy of the Lusitania murders; of innumerable violations of The Hague convention and the law of nations; of abominable and perfidious plotting in friendly countries and shameless abuse of their hospitality; of crime heaped upon crime in hideous defiance of the laws of God and men. I cherish the memories of my youth, but these very memories make me cry opt in pain and wrath against those who have befouled the spiritual soil of the old Germany in which they were rooted."—*Otto H. Kahn.*

## MAKING EFFICIENT AMERICANS.

In his recent address before the St. Louis Commercial club Dr. Nicholas Murray Butler, president of Columbia university, asserted that "the unpreparedness of America for war and for peace is now obvious to everybody." Because this hard saying is bitterly true, the constructive program outlined by Dr. Butler should have the attention of intelligent Americans. His address was published in full in The Daily News. No part of it is more arresting than that in which are presented plans for providing the young men and young women of the United States with national training for national service.

Training for national defense is not, as has been shown in recent weeks in the great cantonments of this country, a mere matter of teaching the effective use of weapons of destruction. There is an equal necessity for training in the skilled employments of peace. It has been estimated, Dr. Butler points out that nearly 200 peaceful trades and occupations must have their skilled workers in order that a modern army may engage in its grim business of striking down the enemy. Therefore many young soldiers and sailors are being diligently instructed in occupations of peace, they having failed amid their home surroundings to acquire that skill of hand and brain necessary in performing the world's productive work.

Why wait till war comes to teach young men to defend their country? Why wait for an enemy to drive us to the task of imparting to young men skill in productive employment? To maintain a state of unpreparedness for both war and peace in normal times is mere blind folly. Dr. Butler argues that universal military training for the young would constitute "a call to citizenship," a method of Americanization most valuable to all the elements of our population. Further, by such training each young man would be "physically and intellectually prepared to

take part in his country's service or his country's defense." Again, the instruction thus imparted should give thru vocational training and guidance specific direction to his capacities and powers. "If it be objected that this is too large a task," says Dr. Butler, "the answer is that it involves the training in any one year of only about as many individuals as are now annually enrolled in the public school systems of New York and Chicago and that the nation's security depends upon its accomplishment."

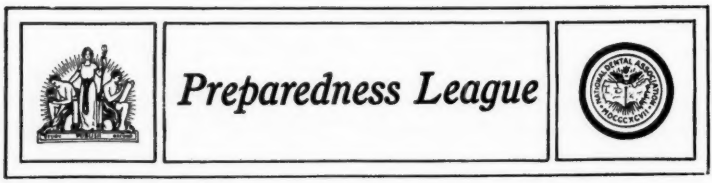
Dr. Butler makes the sound observation that the great new cantonments ought to be made permanent institutions for the systematic training of the nation's young manhood for national citizenship, national defense and national service in the arts of peace. He is right. He makes the further valuable suggestion that the demobilization of our citizen armies after the war should include the training of every soldier who needs it in some form of skilled labor by which he may honorably and adequately support himself and his family.—*Chicago Daily News.*

## A PACIFIST'S ARGUMENT.

The world of unreality which the pacifist lives in could hardly be better illustrated than by an assertion reported from and address by Mrs. Lucia Ames Mead, one of the leading peace at any price propagandists. Mrs. Mead is reported to have alleged that military training is mostly digging with pick and shovel and results in round shoulders and other deplorable physical effects.

Any one who has seen an American regular must be impressed with the accuracy of this theory. Any one who has been in Germany and observed the carriage and physique of the German soldier, or in France, or in Japan and watched a body of their citizen soldiers would be impressed with Mrs. Mead's reliability and turn pacifist at once.

As a matter of fact, one of the benefits which may be confidently expected from general military training is the physical benefit to the American youth, a training in carriage, posture, clean muscled development, lung capacity, and standards of bodily care. Compare a German or French peasant before and after his term of service and the protesque notion of this extremist will be put where it belongs.




# VALUE OF EDUCATIONAL WORK OF THE LEAGUE.

By H. A. Pullen, Buffalo, N. Y.

(Read before the National Dental Association at Its Twenty-First Annual Session, New York City, N. Y., October 23-26, 1917.)

One of the objects of the Preparedness League has been the formation of sectional units in the various cities of the country for the purpose of local organized effort along the lines of the League work.

With such a system of nuclei the dental service for recruits and conscripts has been most effectively rendered as attested by the statistics presented by the chairman, and as will be shown the reports of the various units.

Another phase of the League work to which the formation of sectional units readily lent itself is the educational campaign along the lines of a study club course in War Dental Surgery conducted by the Educational Committee of the League of which I have the honor to be chairman.

The organization committee has faithfully endeavored to make the League of service in every possible way, not only to the dental profession but to the government and to the army and navy.

Feeling that the applicants for enlistment in the dental Reserve Corps needed special instruction in subjects pertaining to War Dental Surgery, an Educational Committee was selected and appointed to provide an outline of subjects for a study club course which could be followed by the sectional units in the various cities as well as by the colleges in their efforts in this direction stimulated by the work of the League.

The study club course in war dental surgery recommended by the Educational Committee of the Preparedness League of American Dentists includes a comprehensive course of study of the anatomy, pathology and surgery of the mouth and jaws with special reference to wounds and disease of the jaws caused by bullets, shell, shrapnel, etc.

Additional subjects of military importance to the officers of the Dental Reserve Corps are included in the study club course and instruction therein should be obtained from an army dental surgeon if possible.

The actual requirements of an applicant for the Dental Reserve Corps are of a lesser scope than would be included in this course but it is desirable that the dentist qualify himself by a comprehen-

sive course of study and clinical practice for the diagnosis and treatment of the actual conditions presenting in war dental surgery as well as to take his place on the medical staff of the army with some degree of intelligence of what should be required of him in the line of duty and discipline in the Army or Navy.

The course as outlined may be condensed into an extensive course of instruction of a few weeks in case of emergency or carried on thru the year on an elaborated scale with laboratory and hospital clinics accompanying.

If there is a dental college in the city in which the sectional unit of the League is located, arrangements should be made to use the lecture staff and auditoriums of the college for giving lectures. In case there is no dental college near at hand, the lectures on special subjects not given by the divisional heads as the oral surgeon, orthodontist, radiographer et al., located in the city should be given by outside talent engaged for the purpose with special subjects designed.

**SYNOPSIS OF STUDY CLUB COURSE IN WAR DENTAL SURGERY.**

1. Anatomy of Osseus Structures of Jaws and Face.
2. Anatomy of the Plastic Tissues of the Jaws and Face, including Blood and Nerve Supply.
3. Pathology of the Mouth with Special Relation to War Dental Surgery.
   - (a) Sepsis, Antisepsis and Asepsis.
   - (b) Ankylosis.
   - (c) Tetanus.
   - (d) Gangrene.
4. Clinical Diagnosis of Oral Lesions Produced by Gunshot Wounds, Shell, Shrapnell, etc.
5. The X-ray in War Dental Surgery.
   - (a) Location of Bullets, Pieces of Shell, etc.
   - (b) Definition and Location of Fractures.
   - (c) Location of Sequestrae.
   - (d) Split and Fractured Roots of Teeth.
   - (e) Abscessed Teeth.
6. Fractures of the Jaws.
   - (a) **Diagnosis**
     - Simple, Compound, and Comminuted Fractures.
     - Loss of Sequestrae of Bone Including Teeth.
     - Loss of Section of Maxilla or Mandible.
   - (b) **Surgical Treatment**
     - Removal of Sequestrae, Loose Teeth, Pieces of Shell, etc.
     - Breaking up of False Unions.
     - Restoration of Occlusion of the Teeth.
     - Setting Fractures.
     - Treatment of Septic Infection.
   - (c) **Mechanical Treatment**
     - Fixation of Fractured Parts in Simple and Compound Fractures.
     - Bandaging and Contra-indications for its use.
     - Splints and their Construction.
     - Wiring of the Teeth and Jaws.
     - Fracture Bands and their Adaptability.
     - Special Orthodontic Devices Applicable for Readjustment and Fixation of remaining Segments of the Jaws after Loss of Jaw Sections.
     - Preparation of mouth for the work of the Plastic Surgeon in severe cases.
7. Dental and Oral Surgery in Preparation for Subsequent Operations by the Surgical Staff.
   - (a) Prophylactic Treatment, Cleaning of Tooth Surfaces, Removal of Calculi, Removal of Sequestrae, etc.
   - (b) Filling of Carious Cavities.
   - (c) Treatment of Abscessed Teeth.
   - (d) Removal of Fractured Roots.
   - (e) Construction of Special Splints and Metallic Forms over which Plastic Facial Reproduction may be done.
8. Anaesthesia.
   - (a) General Anaesthesia, including administrative technic and effects of ether, chloroform and nitrous oxide and Oxygen.
   - (b) Local Anaesthesia, including administrative technic and effects of cocaine, novocaine and their allied preparations for local anesthesia.
   - (c) Conductive Anesthesia and the technic of nerve blocking and its local and general effects.
9. Prosthetic Restorations.
   - (a) Restoration of the Front Half of Maxillae.
   - (b) Restoration of Front and Side of Maxillae.
   - (c) Restoration of one-half of Mandible.
   - (d) Restoration of Entire Mandible.
10. Bone Grafting in the Jaws.
11. Instruction in First Aid, Control of Hemorrhage, Bandaging, Temporary Splinting, etc.
12. Military Administration and Practice.
    - (a) Army Regulations relating to the Dentist as an Officer in the Army.
    - (b) Duties of the Dental Corps as defined by the Manual of the Medical Department of the Army.
    - (c) Instruction in preparation of reports and returns of the dental officers in line of duty in field or hospital.

13. Military Law.
    Manual for Courts Martial of the Army and Navy (Official).
14. Dental and Oral Practice in the Army and Navy.
    (a) In relation to the service.
    (b) In relation to the Administration and Supply Department.
    (c) In relation to other military duties of Dental Surgeons.

**TEXTBOOK REFERENCES.**

Anatomy .....Gray, Cryer
Fractures .....Brophy, Marshall, Angle
Pathology .....Black
Radiology.....Tousey, McCoy, Raper, Satterly
Anesthesia.
General Anesthesia .....Gwathmay
Local and Conductive Anesthesia.....
.....Thoma, Fisher
Bone Grafting .....MacEwen
Prosthesis .....Turner
Military Regulations and Manuals.
Army Regulations.
Manual of the Medical Corps.
Manual for Courts Martial of the Army and Navy.

The course as outlined has been followed by the various sectional units and by many of the leading dental colleges of the country with a great deal of satisfaction.

In some of the localities where there have been no dental colleges, lantern slide lectures on some of the more important war dental surgery subjects have been provided by the educational committee, and if there is enough of a demand for them, copies of the lectures of authorities on many more subjects will be solicited by the committee and furnished to those units desiring them.

At the university of Buffalo where a special war dental course is being given, typed copies of the lectures are furnished to the students who are for the most part busy dentists and forced to take an intense course of study in a short time, but by means of the copies of the lectures which they will later on have more time to study thoroly, they have a better opportunity to digest them.

In conclusion I will say that the Educational Committee is anxious to render every assistance in its power to the dental reserve corps and prospective applicants in the way of fitting them for the unusual services they have to perform in war dental surgery and will welcome any suggestions of practical value, which will help us to send the best prepared, and the best trained men to the front of any country in the world.

**REMARKS.**

DR. RINEHART, Kansas City: Our unit in Kansas City is extremely anxious to do its bit, and we are doing it. We have had a very successful course of instruction. I want particularly to speak of the organization of the ambulance units. We are raising funds for an ambulance to be sent to France. We have already $1000 and will have the balance in the near future. I would like to compliment Dr. Weaver, of Cleveland, for his plan of the ambulance unit. Nothing too good can be done for our boys in the trenches. I wish Dr. Weaver would get up a booklet showing the work he has done on these units, for distribution. It would be of use to everyone who wants to study the proposition, which is a very big one from every point of view, and one of which we have to study ways and means, and get the opinion of experts as to raising the money. The work of the Preparedness League is just beginning and I am reminded of a phrase I heard the other day: "We are not trying to do the things that Napoleon accomplished, but the work that be left undone."

DR. W. D. TRACY, New York: I regret that my duties in connection with the meetings have kept me on the other side of the building, but I enjoyed hearing Dr. Rinehart's remarks. The subject is of a stupendous nature, as it is a pretty big task to look after the dental needs of thousands of men. Our work should not only continue, however, but we should go forward with a feeling of encouragement. I believe that the dentists in this country are facing the biggest opportunity that they have ever had and it is a question now as to whether our response will be big enough to take care of the problem. As we have heard continuously

good reports, I am optimistic. I believe that when the history of this undertaking is written up it will be greatly to the credit of the dental profession. The main thing, however, is to take care of the men in the trenches and that comes before everything else.

In getting the work of the Northeastern department organized, I found a ready response. The men were in agreement and anxious to go shoulder to shoulder in pushing forward the work. We have had to correct many of our own mistakes and blunders, but naturally it takes a little time to get the organization going perfectly straight. I singled out men whom I felt we could count on, men who were good citizens. We got into communication by mail and then by interview. A personal interview, I find, makes for the best results. When I selected my state chairman I got them to single out other men on whose co-operation they could rely. These men had to reach out into the outlying districts and to submit their reports in their turn to the state chairmen. While I have had some difficulties I hope that they have been overcome. Some men were lacking in enthusiasm and said what is the use of strengthening the organization when the first draft is over. Now, I said, while there is a lull, you can get your papers ready, get your card index ready and you can be Johnny on the Spot for the second draft. In Brooklyn they have done splendid work. They have reorganized their affairs there and if you are interested in the detail of the system, Dr. Frank T. Van Woert, of Galen Hall, Brooklyn, has the most simple, thoro, and efficient method of taking care of these things that I have ever seen. There should be no hesitation in asking him to explain this system, as Dr. Van Woert is one of those who is always ready to give his help generously. Some of you may prefer to keep to your own scheme, now it is started, but some of you may be very glad to see his work.

I am sorry that I have not something more formal to offer you, but I assure you that now we have this thing started that we are going to push it.

## THE MISSOURI PLAN.

Free dental work has been done since last August for 2,500 soldiers, sailors, marines and other enlisted and drafted men in St. Louis to fit them for military service. One hundred dentists have co-operated with Lieut. J. P. Harper, chairman of the dental section of the Medical Advisory Board of Missouri in the work.

On each of the 166 local boards in the State of Missouri is a dentist, who examines the teeth of the drafted man. If the man needs dental work, and is in Class 1, he is given a card to a local dentist, who does the work free. There also are 108 Medical Advisory Boards in the state on each of which is a dentist.

When a St. Louis drafted man needs dental work he is given a card to Lieut. Harper, who is Secretary of the St. Louis University Dental College. The man presents his card and if the two officers of the dental corps at the college are not able to do the work, he is recommended to one of 100 co-operating dentists in the city. The work is so well regulated that more than forty negro dentists also have pledged their aid and do the work for the men of their race who are selected for military service.

All types of the most expensive work are done for the men, where required. X-rays are taken, plates are put in, and the free dental work frequently is of the

type that would cost a civilian many dollars.

Lieut. Harper explained to a reporter for The Star that it has been found where a man has defective teeth, or abscesses, of which he may not even be aware, any wound he may suffer is doubly slow in healing. For this reason, it was decided to send every man into the field with a clean mouth and every tooth perfectly filled.

The first work done by the St. Louis University College last August was on the teeth of 800 members of Battery A. Since that time, all drafted men have been cared for, and men from Scott Field, the Marines, the Navy and Jefferson Barracks have been accommodated. There is a staff of dentists at the Barracks, but they have been unable to care for all the men, and many are sent to Lieut. Harper and he pro-rates them among the dentists in the city who have volunteered for the work.

While a reporter was present at the College yesterday, a sailor, a drafted negro and a soldier from the barracks came in for dental work. Applicants number from 10 to 50 a day. The men need not necessarily be Missourians, but must have a card from local board or military authority, if already in the service.—*St. Louis Star, February 22, 1918.*



## DENTAL MOTOR CAR INFORMATION.

In order to get the Dental Motor Car project properly before the dental profession and give them an idea of what has already been done in the way of the first models, I am asking the editors of all the magazines to publish the following statement:

It has been arranged by the Chairman of the Dental Motor Car Committee to have sent to any person interested in Dental Motor Cars sets of photographs showing all details of the Car direct from the photographer at the following prices:

1-Set-10-Plain Prints, $2.00

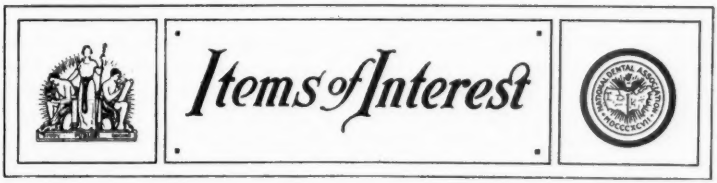
1-Set-10-Linen Prints, $2.50.

1-Set-10-Lantern Slides, $5.00.

Send to the following address for these photographs: Harry C. Beitt, 12970 Emerson Ave., Cleveland, Ohio; Commercial Photographer.

Respectfully yours,

S. M. WEAVER, Chairman.




## CAMP PIKE DENTAL SOCIETY.

Camp Pike, Ark., Jan. 25th, 1918.

Dear Editor: On January 8th, 1918, the Dental Surgeons of Camp Pike organized a society, naming it "Camp Pike Dental Society."

Col. John H. Hess, D. C., the Division Dental Surgeon, was elected Honorary President, 1st. Lt. Edgar T. Blocher, D. R. C., President; 1st. Lt. Henry W. Rich, D. R. C., Vice-President; 1st. Lt. George H. Elliott, D. R. C., Sec'y-Treas. The object of the society is to increase the efficiency of Dental Corps, bringing the members closer together, to broaden their knowledge along certain specific lines mainly that of Oral and War Surgery. The meetings are held Tuesday evenings of each week.

Yours truly,

GEORGE H. ELLIOTT,
Sec'y-Treas.
335th F. Artillery, Camp Park, Ark.

## LOCAL SOCIETY ORGANIZED AT CAMP SHELBY.

Camp Shelby, Miss., 2-18-18.

Dear Bro. King:—

Somewhat tardy, but you will find enclosed my check for one dollar. I sincerely hope the desired $30,000 mark was reached, and may this make it read $30,001.00.

We now have thirty dentists down here, the majority of whom come from Indiana. No doubt you are familiar with the work being done in the camps, but due to energies of our Division Dental Surgeon, we have organized a local society which meets every Thursday night. In this way we become closer acquainted and receive local topics first hand from the Major himself. We also have a paper or two, read by one of the members. These are, as a rule, original but frequently we have one read from the National Journal and of course the discussion which follow always bring out many points we would overlook in reading to ourselves.

Starting next week we are to have a series of papers accompanied by clinics, these to be given by some of the bright lights of our profession. These men will come from New Orleans, St. Louis and surrounding cities at their own expense,

all, so we may be able to keep in touch with the better dentistry and continue to practice it in the service.

Now I didn't start out to write a letter but thought you would be pleased to learn that we are keeping up with the new things, thanks to many interesting articles in The Journal of the National Dental Association. Please change my address and send my Journal to

Fraternally yours,

LT. SAMUEL H. DAVIS, D. R. C.,
Care Divisional Ammunition Trains,
Camp 7 Hospital, Camp Shelby, Miss.

## TECHNIC OF REMOVING IMPACTED MOLARS.

December 11, 1917.

My Dear Editor:

In your November issue there is a paper "Technic of Removing Completely Impacted Lower Third Molars, Requiring no Post-Operative Treatment" upon which I would like to offer the following criticism:

While the caption refers to **Completely impacted molars,** the drawings illustrating the case and method distinctly show a tooth which is far from being **impacted,** strange to say.

Now a tooth cannot possibly be "impacted" unless, by its abnormal position, it is prevented from erupting by some other tooth or teeth standing in the way.

The drawings illustrating this paper show a very normal unerupted lower third molar—nothing more, nothing less. It is seen to stand well away, unusually far away, from the second molar, has plenty of room to erupt, and if given a chance would undoubtedly have erupted into its normal position.

While the technic described would undoubtedly answer very well for such an unnecessary operation, anyone experienced with real impacted molars will readily recognize its total impossibility for such cases.

While the directions for the various steps in the operation are mostly good, there are two in particular which cannot be accepted as correct.

8. No plain skiagraph can possibly indicate exactly the position of the unerupted molar; it only gives one an approximate idea.

11. To "swab out the socket with sterile sponges" is generally recognized as very bad surgical practice, and should under no circumstances be done.

Yours very cordially,

C. EDMUND KELLS.

## INTERPRETATION OF THE WASSERMANN TEST.

The Wassermann test must be carefully done, many controls used, and all possible precautions exercised. When so done, a strong positive means syphilis almost invariably. A weak positive in itself does not necessarily prove syphilis, even with the best workers. In a general way, the stronger the test the more active the disease. A negative result never proves the absence of syphilis. Repeated negatives, especially by different men, are of more value. A negative result after the provocative dose is still more conclusive. Yet after all these negative results, a case may occasionally be syphilis. The test is indispensable as an indicator of the progress of a case under **treatment.**—*Extract from Ohio State Medical Journal.*

## PERSONAL HYGIENE WOULD SAVE MONEY.

Indianapolis, Feb. 22.—Here's cheering information—for doctors only.

Eighty-four thousand of Indiana's 2,750,000 inhabitants are confined to their homes every day of the year.

This is straight from Dr. J. N. Hurty, secretary of the state board of health, who speculates thus:

"Suppose each case of sickness costs $1, then our daily sickness bill is $84,000."

According to Dr. Hurty, each of the 800,000 workmen of the state loses an average of nine days each year because of illness. If each earns only $1.50 a day the total loss of wages for the year will be $10,000,000, and the total annual cost of medical treatment at this rate will reach $100,000, according to Dr. Hurty's calculations.

A further unestimated loss exists for the shortening of the laborer's life and diminution of his efficiency thru sickness, he states.

Moral: Most of this illness could be prevented by the exercises of personal hygiene, instead of a dependence on an unknown something out of a bottle to cure it.—*Chicago Tribune.*

## APPROPRIATE $1,000 FOR DENTAL MATERIALS.

Dear Doctor King:—

I am pleased to inform you that the Common Council of the city of Detroit appropriated $1,000.00 to furnish dental materials to be used in the care of the teeth of the Selective Service Men.

I do not know whether or not city governments are doing anything to assist in this way.

The Council saw the justice of our claim, and readily allowed same. They were particular to know, however, to whom this dental service would be given, and they were informed that this would only be done in cases where defective teeth were the only rejection. In other words, it would be necessary for a man to be fit in every other respect before The Preparedness League would do the necessary dental operation. In that way, we would be able to reach the greatest number of conscripts.

The following is a copy of letter addressed to Common Council, Detroit, Mich.:

To the Honorable Common Council of the City of Detroit:

Gentlemen:—

The United States Government, thru the Surgeon General's Office, is doing all in its power to see that every Selective Service Man for The New National Army, be made dentally fit before going into training.

The great need for Dental Service in The European Armies has been made manifest in thousands of cases; to such an extent that the English Government had to call for many dentists in civil life to enlist in the Dental Service of the army. The great amount of suffering due to teethache, abscesses, exposure thru wet feet and cold has incapacitated thousands of soldiers. This is apart from surgical interference which might befall the soldier thru neglect in the care of these conditions. Men are being rejected daily on account of poor teeth and the absence of teeth. These men can be made dentally fit; thereby gaining thousands of soldiers who otherwise would be unfit.

The Preparedness League of American Dentists has done considerable work thruout the country in correcting the diseased conditions of the mouths of prospective soldiers. While a great deal of work has been done, much remains to be accomplished. There are forty-nine State

Directors who have charge of this work in The United States; one for each state, who are authorized to organize the various counties.

The dentists have contributed liberally of their time and funds in the furtherance of this work, but feel the necessity of asking the city to contribute $1,000.00 with which to purchase materials for this work. We feel justified in asking this appropriation at this time, as it will enable a large number of men to qualify for service who otherwise would be exempted, and as this is a matter of national concern, we ask that your Honorable Body give this matter favorable consideration.

Very respectfully,

GEORGE F. BURKE,
Director for the State of Michigan.

A. C. THOMPSON,
Chief Dental Inspector, Board of Health.

C. H. OAKMAN, Cha'n.

Very truly yours,

C. H. OAKMAN.

## DENTAL CARIES.

So little is definitely known regarding the metabolic or nutritional changes which the teeth experience in the course of their development that even the larger textbooks of physiology have little or nothing to say on this subject. It must be evident, however, that aside from the intrinsic interest in the knowledge of the processes of dental development as such, no fundamental understanding of the nature of dental caries can ever be expected until the physiology of the teeth has been extended in the field just indicated. For several years, Gies and his collaborators in the Bio-chemical Laboratory of the Schools of Medicine and Dentistry of Columbia University have been engaged in investigations of the problems of dental physiology, pathology and chemistry. Recently Gies[1] has pointed out that unless substances originating outside of the enamel can enter or superficially affect the cells involved in the production of this substance, it is scarcely justifiable to assume that such dental development can be influenced to any extent thru products circulating in the blood. However, experiments have now shown that after intraperitoneal injection, a dye like trypan blue passes freely into the enamel of developing teeth, where the blue pigment seems to remain indefinitely; it does not pass from pulp thru dentin into enamel of fully erupted teeth. Furthermore, after the oral administration of strontium salts daily for some time to young animals, this element accumulates in the solid parts (and is present in the pulp) of the first and second sets of teeth, apparently taking the place of calcium. In a further endeavor to ascertain whether "influences from the inside," as Gies terms those of a nutritional type and involving internal secretions, may be responsible factors in the incidence of dental caries, the effects of a withdrawal of normal nutritive influences possibly exerted by some of the endocrine glands were tested. As a result it is reported that there were no effects on dentition after thymectomy, thyroparathyroidectomy and castration; deficient calcification of the teeth (incisors) followed parathyroidectomy. When various gland products were fed to white rats, dental calcification appeared to be (a) regularly decreased by oral administration of lmyphatic, salivary or thyroid gland; (b) regularly increased by oral administration of testicle, and (c)

[1]Gies, W. J., and Collaborators: Studies of Dental Caries, with Special Reference to Internal Secretions in Their Relation to the Development and Condition of Dental Enamel, Proc. Soc. Exper. Biol. and Med., 1917, 15, 5.

wholly unaffected by oral administration of corpus luteum, parathyroid, pineal, pituitary, spleen, suprarenal or thymus. If the decay of teeth is associated in any degree with local deficiency in the structure and quality of the enamel, experiments like these are likely to help in the interpretation of what is at best a complex problem. As Gies points out in connection with his findings, whether or not there is true nutritive or maintenance metabolism in normal enamel, there may be physiologic or pathologic exchange of materials in enamel by diffusion from blood thru dentin and enamel to oral fluids, and vice versa. We must bear in mind, however, that decay may perhaps arise regardless of the normality of the enamel; for teeth are always liable to trauma and to local specific disintegrative influences capable of initiating or paving the way for harm quite independent of the composition of the teeth.—*Editorial, American Medical Journal, issue January 28, 1918.*

## COUNTRY BOYS NOT PHYSICALLY SUPERIOR.

In order to determine whether the average of physical soundness is higher among country boys than among city boys, the following comparison was made: Selection was made of a typical set of cities of 40,000 to 500,000 population, with no large immigrant element, and distributed over ten different states (Alabama, Arkansas, California, Colorado, Kansas, Montana, Nebraska, New York and South Carolina), and a corresponding set of counties of the same total size, located in the same states and containing no city of 30,000 population, the total number of registrants in the two areas being 315,000. The result of the comparison was as follows: Of 35,017 registrants in urban areas, 9,969 were rejected; of 44,462 registrants in rural areas, 12,432 were rejected, or 28.47 per cent. of city boys and 27.96 per cent. of country boys. The result, therefore, was practically a tie, showing that the country boy does not possess a greater degree of the physical soundness necessary for his acceptance as a soldier.—*Journal A. M. A., issue January 12.*

## PREVENTION INSTEAD OF CURE.

An hour's visit to any of the free clinics of Chicago will impress you forcibly that the big thing needed is not so much the cure as the prevention of disease. The facts are that preventive agencies are lacking and the curative agencies are undermanned, overworked and underpaid. If only the preventive side, as affecting public health, was brought to the highest standards of efficiency, it would immeasurably relieve the forces of noble men and women, i. e., doctors and nurses, now struggling to cope with the overwhelming mass of curative work that confronts them each day of their working lives. And this means that the skilled physician must find remunerative employment for the services he is able to render in the field of preventive medicine.—*Bulletin.—Department of Health, Chicago.*

# Deaths

## JOHN R. CALLAHAN.

The death of Dr. John R. Callahan is a great loss to dental science. Dr. Callahan's professional activities took him far beyond the routine of his practice. He labored for the general advancement of his profession and had no small share in widening the scope of dentistry until it became one of the important factors in general diagnostics. From his laboratory came many contributions to dental science, the harvest of experimentation as unselfish as valuable. The scientific imagination was one of Dr. Callahan's attributes, the ability to see beyond the immediate causes, into the causes of causes, to trace symptoms to their source instead of being satisfied with superficial manifestations.

Dr. J. R. Callahan, in the Research Laboratory in the Dental Department of the Cincinnati General Hospital. Picture taken a few days before his death.

There is something heroic about a professional career that so quietly contributes to the general good of humanity. There is no perfervid appeal to "the peepul" to recognize service in their behalf. The emoluments are in no sense commensurate with the achievements. The effort finds its reward largely in the effort itself and in its scientific fruition.

Any praise from the outside world comes largely from the few possessed of the special knowledge that equips them for appreciation.

Such was Dr. Callahan's career—the unselfish labor of a scientist in humanity's behalf. He worked hard, accomplished much, and received his meed of praise from those familiar with his achievements. The greatest tragedy of his death lies in the things that he would still have accomplished and which he was forced to relinquish to other heads and hands. —*Editorial in Cincinnati Times-Star, February 15, 1918.*

### DR. JOHN ROSS CALLAHAN.

Born in Higginsport, Ohio, June 28, 1853, son of Dr. Denis Callahan, Physician and Dentist, Hillsboro, Ohio; graduated Philadelphia College of Dental Surgery 1877. Began practice San Francisco, California, 1877. Returned to Hillsboro in 1879, in practice there until 1890. Located in Cincinnati 1890, succeeding to Dr. C. R. Taft's practice. Active in national, state and local societies. Secretary for several years and President 1891 (Ohio State Dental Society). President of Cincinnati Dental Society 1906 and 1907. Pioneer in research work. Received Jarvie Medal, Rochester, N. Y., May, 1917. Head of Dental Department Cincinnati General Hospital. Director of Research Cincinnati Research Club. Member of Cincinnati Research Society. Honorary member of many state and local societies. Ardent member Delta Sigma Delta Fraternity. Married 1880, family surviving: wife, two daughters and one son. Death occurred during Tuesday night, February 12th at Queen City Club, apoplexy. Funeral services at chapel of the Cincinnati Crematory, 4 P. M., Friday, February 15th.

#### Pall Bearers.

Elliot H. Pendleton, Prof. B. W. Foley, Dr. A. B. Thrasher, Dr. William H. Taggert, Dr. T. Irving Way, Dr. Frank A. Hunter, Dr. E. E. Hall, Dr. Henry E. Germann.

#### Honorary Pall Bearers Representing the Various Societies.

National Dental Research—Dr. Weston A. Price.

National Dental Association—Dr. L. E. Custer.

Ohio State Dental Society—Dr. Z. N. Wright.

Indiana State Society—Dr. Carl D. Lucas.

Cincinnati Dental Society—Dr. Walter P. Stewart.

Cincinnati Academy of Medicine—Dr. J. H. Landis.

Cincinnati General Hospital—Dr. A. C. Bachmeyer.

University of Cincinnati—Dr. C. W. Dabney.

Cincinnati Dental Research Club—Dr. C. Stanley Smith.

Cincinnati Delta Sigma Delta Fraternity—Dr. C. P. Sweny.

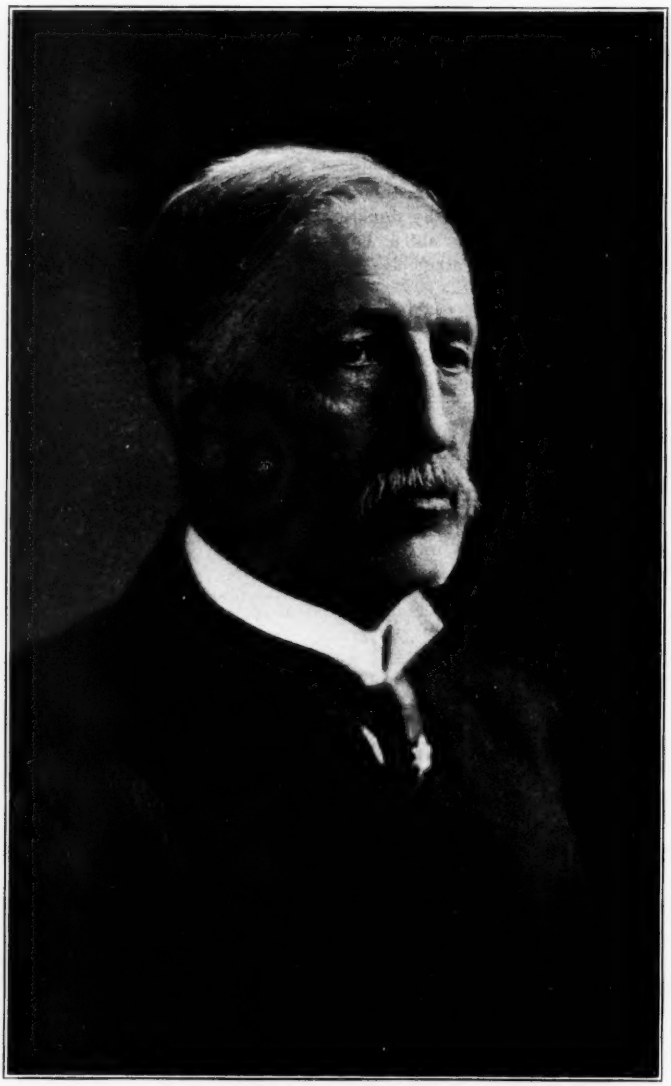
Miami Valley Dental Society—Dr. A. J. Lewis.

Columbus Dental Society—Dr. W. I. Jones.

---

**Dr. Edgar V. Burt,** of LaFayette, died on Monday, March 11, 1918. Dr. Burt was born in LaFayette April 6, 1840, and had he lived until the 6th of next April he would have been 78 years old. He worked at his practice until the last few weeks and on the 1st of February he achieved the distinction of having been engaged in dental practice for 60 years, during all of which time he was in the same office rooms. It is probable that while other dentists had served as long or longer in the profession than did Dr. Burt, that he was the only one on record who was located in the same office rooms for the entire time.

On the 1st of February, the anniversary of his sixtieth years in practice, the West-Central Dental Society—of which he was President—sent him sixty carnations. In addition he received flowers of Mrs. W. H. Herriott and Son and also from different business associates of his in LaFayette Telegrams and letters of



DR. EDGAR V. BURT, LaFayette, Indiana.
Sixty years' continuous practice in the same office.

congratulations came to him from all parts of the State and a few from beyond the borders of the State.

At a meeting of the LaFayette Dental Society on Tuesday evening, March 12th, the following testimonial was adopted by all of the LaFayette dentists:

In the death of Dr. Edgar V. Burt, of LaFayette, which occurred on March 11, 1918, the dental profession of Indiana loses a distinguished member. He was Dean of the Life Members of the Indiana State Association, having joined that organization in 1864; at the time of his death he was the President of the West-Central Dental Society, a district Society embracing eight counties.

Dr. Burt achieved the rare distinction of being actively identified with the dental profession for sixty years. Thruout his professional career he maintained high ethical standards, lofty devotion to professional ideals, and a quiet but firm insistence that Dentistry was more than a business and was entitled to rank as a life work.

The dentists of LaFayette, to whom Dr. Burt was a constant inspiration and a never failing friend, feel that in his death they have suffered an irreparable loss. Their sympathy is extended to Mrs. Burt and the other members of Dr. Burt's immediate family; and they join with them in their time of sorrow in appreciation of their great loss.

THE LA FAYETTE DENTAL SOCIETY.
Dr. C. G. Ross, President.
Dr. L. M. Childers, Secretary.

**Dr. Isaac H. Davis,** a dentist connected with the University of Maryland for thirty-four years, died at his home 20 Overhill road, Roland Park, from pneumonia, following a fall on the ice January 15.

Born in Frederick county, Maryland, 56 years ago, Dr. Davis was graduated in medicine and dentistry from the University of Maryland in 1884 and had been connected with the institution ever since. He occupied the chair of associate operative dentistry for more than 10 years, and in the last 10 years was professor of operative dentistry.

He was a regent of the University of Maryland five years and was recognized as a leading authority on dentistry. He was a member of Fayette Street Methodist Episcopal Church 25 years and one of the official board. For a number of years he was leader of the choir. He was a member of the alumni association of the University of Maryland and a former president.

Dr. Davis married Miss Eleanor B. McParlin, daughter of the late Surg.-Gen. Thomas A. McParlin, 13 years ago. She survives him, with a daughter, Miss Katherine Roca Davis, and two sons, Thomas McParlin Davis and Isaac H. Davis, Jr.

## NATIONAL SOCIETIES.

National Dental Association, Chicago, Aug. 5-6-7-8 and 9.

National Association of Dental Faculties, Chicago, Congress Hotel, Green Room, Aug. 2-3, 1918.

National Association of Dental Examiners, Chicago, 1918.

Xi Psi Phi Fraternity, Chicago, 1918.

Delta Sigma Delta Fraternity—Aug. 5, 1918, Chicago, Congress Hotel.

Psi Omega Fraternity National Alumni Chapter, Chicago, Aug. 5, 1918.

Association of Military Dental Surgeons, Chicago, 1918.

American Society of Orthodontists, Edgewater Beach Hotel, Chicago, Aug. 1-3, 1918.

American Medical Association, Chicago, June, 10-14, 1918.

## STATE SOCIETIES.

### May.

Indiana—May 21-22-23, Claypool Hotel, Indianapolis.

Iowa—May 7-8-9, Des Moines.

Massachusetts—May 1-2-3, Boston.

Nebraska—May 20-23, Lincoln.

Illinois—May 14-17, Bloomington.

### June.

Kentucky—June 13-14-15, Lexington.

Wyoming—June 10, Thermopolis.

Georgia—June 12-13-14, Atlanta.

Maine—June 26-27-28, Portland.

New York—June 12-13-14, Saratoga Springs, N. Y.

Colorado—June 20-21-22, Estes Park.

South Carolina—Jefferson Hotel, June 27-28-29, Columbia.

North Carolina, June, 19-20-21, Wilmington. Headquarters, Oceanic Hotel.

Florida—June 20-21-22, Atlantic Beach.

New Mexico—June 20-21-22, Albuquerque.

Arkansas—June 13-14-15, Little Rock.

### July.

Wisconsin—July, Milwaukee.

New Jersey—July, 17-19, Atlantic City.

Porto Rico—July, San Juan.

California—July 8-13, San Francisco.

### November.

Arizona—November 15-16-17, Phoenix.

Washington, D. C.—Nov. 6, Chamber of Commerce, Washington, D. C.

District of Columbia—Nov. 20, Washington, D. C.

### December.

Ohio—Dec. 3-5, Columbus.

Maryland—Dec. 15, Baltimore.

## NORTHWESTERN ALUMNI HOMECOMING CLINIC.

The Northwestern University Dental School Alumni Association Homecoming Clinic will be held June 10th and 11th, 31 W. Lake St., Chicago.

Special features have been provided which will insure a successful and interesting meeting. Make your arrangements now to be in attendance. For information address,

DR. M. M. PRINZ, Sec'y,
4235 Lake Park Ave., Chicago, Ill.

## NORTH CAROLINA DENTAL SOCIETY

The North Carolina Dental Society meets June 19-21, 1918, headquarters Oceanic Hotel, Wilmington, N. C.

W. T. MARTIN, Secretary.

## IOWA STATE DENTAL SOCIETY.

The fifty-sixth annual meeting of the Iowa State Dental Society will be held in Des Moines, Iowa, May 7-8-9, 1918. An excellent program has been prepared, including seminars, papers, and clinics. A cordial invitation is extended ethical members of the profession from out of state, to attend any or all of these sessions.

E. R. SWANK, Secretary,
Panora, Iowa.

## KENTUCKY STATE MEETING.

The next annual meeting of the Kentucky State Dental Association will be held at Lexington, Ky., June 13-14-15, 1918. An Amalgam program of special interest. Address all correspondence to Dr. W. M. Randall, Sec'y., Louisville, Ky.

## NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the North Caroline State Board of Dental Examiners will be held at Wrightsville Beach, Wilmington, N. C., beginning promptly at 9:00 o'clock on Monday morning, June 17, 1918. For further information and application blanks address the secretary.

F. L. HUNT, Sec'y,
Asheville, N. C.

## NORTHERN OHIO DENTAL ASSOCIATION.

The annual meeting of The Northern Ohio Dental Association will be held at Toledo, Ohio, June 6th, 7th and 8th.

C. W. CLARK, Sec'y.

## THE NEW YORK STATE DENTAL SOCIETY.

The 50th anniversary of the Dental Society of the State of New York will be held at Saratoga Springs, New York, June 13, 14 and 15, 1918. The Society will endeavor to present a literary clinic and social program for the benefit of the profession in keeping with its Golden Anniversary. A cordial invitation is extended to all members of the National Dental Association. For further information, write

A. P. BURKHART, Sec'y,
52 Genesee St., Auburn, N. Y.

## CALIFORNIA STATE MEETING.

The California State Dental Association will hold its regular Annual Session for the year 1918 in San Francisco, July 8-13.

We will conduct our meeting this year on the Oklahoma Plan, and feel that we can assure all who attend a pleasant as well as a profitable meeting.

Further information may be obtained by addressing the Secretary: Dr. John E. Gurley, 350 Post St., San Francisco.

## MASSACHUSETTS DENTAL SOCIETY.

The fifty-fourth annual meeting of the above named society will meet in the Massachusetts Charitable Mechanic Association Building on Huntington avenue, Boston, Mass., Wednesday, Thursday and Friday, May 1st, 2nd and 3rd, 1918.

WALDO E. BOARDMAN,
Chairman Ex.-Committee.

## NEW MEXICO BOARD OF DENTAL EXAMINERS.

The New Mexico Board of Dental Examiners will meet June 17, 1918, in Albuquerque for the examination of applicants.

M. J. MORAN, Secretary,
Deming, New Mexico.

## NORTH DAKOTA STATE DENTAL ASSOCIATION.

The North Dakota State Dental Association will hold its annual meeting at Grand Forks, North Dakota, May 21-22, 1918.

SOLON CRUM, Secretary,
Fargo, North Dakota.
ALBERT HALLENBERG, Pres.,
Fargo, North Dakota.

## STATE BOARD OF DENTAL EXAMINERS.

The next examination of the Pennsylvania Board of Dental Examiners will be held in Philadelphia and Pittsburgh on Wednesday, Thursday, Friday and Saturday, June 12th, 13th, 14th and 15th, 1918.

The examination in practical work will be in the Evans Dental Institute, 40th and Spruce Sts., Philadelphia, and the University of Pittsburgh, Pittsburgh, on Wednesday, June 12th. The examination in operative work will be held at 8:30 A. M. and the prosthetic work at 1:30 P. M. Applicants are required to furnish all instruments and a patient for the operative work.

The theoretical examination will be held in Musical Fund Hall, Philadelphia, and College of Pharmacy, Pride and Bluff Sts., Pittsburgh, beginning at 9 A. M. on Thursday, June 13th.

Application papers can be secured from the Department of Public Instruction, Harrisburg.

ALEXANDER H. REYNOLDS,
Secretary,
4630 Chester Ave., Philadelphia.

## SOUTH DAKOTA STATE DENTAL SOCIETY.

The 36th annual meeting of the South Dakota State Dental Society will be held at Sioux Falls, May 30-31.

DR. ERNEST W. ELMEN, Pres.
DR. G. R. LANNING, Secretary,

## MAINE DENTAL SOCIETY.

The annual meeting of the Maine Dental Society will be held in the City Hall, Portland, Maine, on June 26-27-28. A splendid program is in preparation and great things may be expected.

J. E. PENDLETON, Secretary,
Lewiston, Maine.

## WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS.

The annual examination of candidates for West Virginia State license to practice, will be held at Parkersburg, W. Va., June 25, 26 and 27, 1918. Blanks and information will be furnished on application to the undersigned.

H. H. SMALLRIDGE, Secretary.

## SOUTH CAROLINA STATE MEETING.

The annual meeting of the South Carolina State Dental Association will be held at the Jefferson Hotel, Columbia, S. C., June 27-28-29.

Respectfully yours
ERNEST C. DYE, Sec'y.
W. BUSEY SIMONS, Pres.

## MASSACHUSETTS STATE MEETING.

The fifty-fourth annual meeting of the Massachusetts State Dental Society will be held in Boston on May 1, 2 and 3, 1918.

J. ARTHUR FURBISH, D. M. D.,
400 Marlboro St., Boston. Secretary.

## INDIANA STATE BOARD OF DENTAL EXAMINERS.

Next meeting of the Indiana State Board of Dental Examiners will be held at the State House, Indianapolis, June 17-22 inclusive. Applications and other information may be obtained by addressing H. C. McKittrick, Secretary, Indianapolis, Ind.

## FOUR STATES POST GRADUATE DENTAL MEETING.

### Alabama, Mississippi, Texas, Louisiana.

### Special Detailed Technical Courses Following the General Meeting.

Owing to the great success of last year's Four States Post Graduate Dental Meeting from an educational standpoint, the President of the Louisiana State Dental Society called a special meeting to elect a Committee to make arrangements for another Post Graduate meeting this year.

The Committee elected was as follows:

General Chairman, J. J. Sarrazin, 424 Godchaux Bldg., N. O., Chairman Committee on Interstate Relations.

General Secretary, Leo. C. Dempsey, 943 Jackson Avenue, N. O.

S: H. McAfee, 1237 Maison Blanche Bldg., N. O., Chairman Scientific Program Committee.

J. P. Wahl, 1135 Maison Blanche Bldg., N. O., Editor of Bulletin and Chairman Publicity Committee.

O. L. Loeffel, 727 Maison Blanche Bldg., N. O., Chairman Committee Arrangements and Hotel Rates.

C. S. Tuller, 729 Maison Blanche Bldg., N. O., Chairman Committee on Exhibits.

J. A. Gorman, 629 Maison Blanche Bldg., N. O., Chairman Committee on Clinics.

C. V. Vignes, 709 Macheca Bldg., N. O., Chairman Committee on Credentials and Registration.

E. B. Ducasse, 735 Maison Blanche Bldg., N. O., Chairman Floor Committee.

A. L. Ducasse, 735 Maison Blanche Bldg., N. O., Chairman Committee on Special Courses.

This Committee, after careful deliberation, passed the following rules:

1st. Place of Meeting, New Orleans, (Grunewald Hotel).

2nd. Date—So as not to interfere with Dental College Exercises, Dental Examining Board Meetings, and so as to have pleasant weather conditions: June 3, 4, 5 and 6 was selected.

3rd. To give each member an equal opportunity to get all that is possible, and not congest the meeting, the membership will be limited to 350 members.

4th. Membership Cards will be issued only to be members in good standing in their State Dental Societies, and to Dentists in the Army and Navy Dental Corps.

5th. The Registration Books will be closed May 27th, (one week before the meeting) to all, except members of the Army and Navy Dental Corps.

6th. Fee: Owing to increased cost of postage and stationery and all other expenses, the membership fee to the General Meeting will be Ten Dollars ($10.00) each member. Special courses, following the General Meeting, Fifteen Dollars ($15.00) each course per member.

7th. No one will be issued a Special Course Card unless he has registered for the General Meeting.

From the above rules, which will be strictly adhered to, you will readily realize the importance of early action, if you wish to avail yourself of the rare opportunities offered at such a meeting. If you happen not to be a member of your State Society, get busy at once, apply to the Membership Committee of your State, for a membership blank, sign it, have it approved by one or two members of your State Society, and send it to your Membership Committee at once, so as to be acted upon at the next meeting of your State Society. After you are elected, lose no time in registering for the Four States meeting.

The subjects decided upon to be taught at the next meeting will be as follows:

Nerve Blocking: Dr. Arthur E. Smith, Chicago.

Technic of Root Canal Preparation, Treatment and Filling: Dr. Elmer S. Best, Minneapolis.

Full Upper and Lower Denture, in

which the bite is as effective as that of natural teeth, and in which lower dentures adhere as much as uppers seldom do: Dr. Rupert E. Hall, Chicago.

Exodontia: Instructor to be selected.

Think of the vast importance of the knowledge to be obtained from the above subjects, then ask yourself the question: Can I afford to miss this meeting? Send your application for membership to the Four States Post Graduate meeting, with your check for Ten Dollars ($10.00) to your State Chairman for endorsement and transmission by him to Dr. L. C. Dempsey, the General Secretary. Members of the Louisiana State Dental Society can apply direct to Dr. Dempsey with membership fee enclosed.

Special committee for Alabama:

Chas. F. Chandler, Chairman, 701 First National Bank Bldg., Montgomery.

F. F. Perry, Secretary, 502 First National Bank Bldg., Montgomery.

J. A. Blue, Treasurer, 502 Brown-Marx Bldg., Birmingham.

Olin Kirkland, 913 Bell Bldg., Montgomery.

C. B. Fowlkes, 812 City Bank Bldg., Mobile.

W. F. McDaniels, Athens.

Special Committee for Texas:

E. W. Smith, Chairman, Dallas.

Tom F. Coyle, Orange.

P. C. Krupp, 905 Union National Bank Bldg., Houston.

M. J. Bisco, American National Bank Bldg., Fort Worth.

B. F. Thielen, 301 Scott Bldg., Paris, Texas.

Special Committee for Mississippi:

M. B. Varnado, Chairman, Osyka.
W. C. Dennis, Jackson.
C. B. Baker, Amory.
A. B. Kelly, Yazoo City.
J. N. Moffat, Shelby.

Yours truly,

J. P. WAHL,

Chairman of Publicity Committee.

## THE ANNUAL MEETING OF THE ILLINOIS STATE DENTAL SOCIETY AT BLOOMINGTON, ILLINOIS, MAY 14-15-16-17.

By Charles E. Bentley, D. D. S., Director of Clinics.

These are wonderful times in the making. Potential changes, that usually demand years in their evolution come to us, comparatively speaking, over night. The world is in a seething caldron, out of which all are looking and hoping for a more refined, a nearer spiritual product than has been the world's wont to behold.

Similarly is our profession changing fundamentally. New theories, new laboratory experiments and new demands of technic have demanded a rewriting of our pathology, physiology and changes in our method of practice. With one fell swoop, volumes of old text-books have been swept from the shelves and a later, more scientific, word has taken their places in undisputed possession.

These radical changes have called for sharp departures from old methods of teaching and practice and in their stead, the introduction of an entirely new technic, based upon a set of principles capable of the closest scientific scrutiny.

The Illinois State Dental Society proposes this year in the character of its papers and the method of its clinics to put itself definitely in line with this latter-day demand.

First as to its clinics.

There will be two days devoted to clinics and two kinds of clinics:

1. AN EXHIBIT CLINIC.
2. A PROGRESSIVE CLINIC.

The Exhibit Clinic will be the usual orthodox one. A questionnaire has been sent to each component society that is calculated to send to this clinic only the best it has and several rare hidden "bits" have already been unearthed, as a result.

The Progressive Clinic is to be more didactic. It is to be a teaching clinic. Seven vital subjects, carefully chosen, will be exploited by 14 selected men;

each having gained eminence in the subjects he is to teach.

The gallery of the Masonic Temple at Bloomington is admirably adapted for this purpose. It will be divided into 14 booths. There will be no demonstration in the Progressive Clinic, the object being to teach the fundamental principle underlying the thing demonstrated and the showing of models and diagrams for that purpose. Some of these subjects will be demonstrated in the Exhibit Clinic. Seven men will be lecturing and demonstrating on one side of the gallery, while seven men will be doing the same thing on the other side upon the same subject. Care in the choice of men has been exercised to the end that the principles taught on one side do not differ from those taught on the other side. In short, it is to be a post-graduate course in duplicate, with men moving from booth to booth to meet the group that awaits them.

The method and character of the clinics this year should be sufficiently attractive to cause men to come in large numbers to the meeting.

Then, the papers are to be of a high order and above all applicable to the thought of the profession today.

Dr. Joseph Beck, the great plastic surgeon, is to give a paper, with lantern slides upon "Surgery of the Face." At this particular time in our history and the service, we are expected to render our boys "over there," this paper should be of interest to many. "Army and Camp Dentistry" by the commanding officer at Camp Grant, is another paper full of timely interest. Again: The Federal Government has requested time for a speaker on matters of importance in the war program. If you are desirous of "doing your bit" and want to know how to do it effectively, hear this speaker.

The note that is causing much mental laceration and anxiety today, in the prosthetic field, is the Hall method of impressions and casts. Dr. Hall will read a paper at the State meeting and a lively discussion is expected.

Dr. Arthur Smith, "Extra Oral Anesthesia" will not only describe his technic, but will amplify the same with a moving picture film.

"Oral Infections" by Dr. H. H. Schumann, a gentleman, who has been a serious student of this phase of the subject and makes no wild or radical statements. Other papers of equal interest have been secured, but for want of space must rest at this reference.

Is this not a feast to which anyone is justified in asking all to come? May 14-15-16 and 17, at Bloomington, Illinois.

COME.

## MAINE BOARD OF DENTAL EXAMINERS.

The Maine Board of Dental Examiners will hold their regular examination beginning July 1st at 8:30 A. M. at the State House.

All applications and fees of $20.00 must be in the hands of the Secretary by June 21st.

The examination for Dental Hygienists will be given at the same time, fee $10.00. Write for application and other information.

WILL S. PAYSON, Secretary,
Castine, Maine.

## FOUR STATES POST GRADUATE DENTAL MEETING.

New Orleans, March 15th, 1918.

Dear Doctor: From the way applications are coming in for membership in the Four States Post-Graduate Dental Meeting, those who procrastinate will certainly lose out. From present indications the membership limit will be over subscribed long before the time set. Membership cards will be issued in the order in which requests are received by mail. Please note the following:

Place of meeting—New Orleans.

Date of General Meeting—June 3-4-5-6.

Date of Special Courses—June 7-8.

Membership limited to 350.

Membership cards will be issued only to members in good standing of their State Society.

Last day for registration—May 27.

Fee, General Meeting—$10.00 per member.

Fee, Special Courses—$15.00 per member.

No one will be issued a special course card unless registered for General Meeting.

Owing to the fact that our Registrar, Dr. C. V. Vignes, has been commissioned in the Dental Reserve Corps, and is subject to the call of the Government, Dr. L. C. Dempsey, the General Secretary, 943 Jackson Ave., will receive all applications and issue membership cards.

The subject selected to be taught at this meeting and instructors positively engaged are as follows:

Dr. Arthur E. Smith—Conductive Anesthesia—which will include all Dr. Smith's latest methods, for the various uses of conductive anesthesia.

Dr. Elmer S. Best—Technic of Root Canal Preparation, Treatment and Filling.

Dr. Rupert E. Hall, Chicago—Full upper and lower Dentures.

Exodontia will be taught by someone of national repute—Instructor not as yet definitely selected.

It will be well to note that the Four States Post-Graduate Dental Meeting of Alabama, Mississippi, Texas and Louisiana is quite different from the various so-called Post-Graduate Meetings held in other parts of the country. At this meeting we offer a General course in which the four subjects are taught in detail by illustrated lectures and clinics to every member, in a General way. At the end of the four days' meeting, after you have heard each instructor and decided upon which subject you would like to get special personal instructions in, you can join that particular class by paying the special course fee. This course will take two days—June 7 and 8.

The committee in charge has made it a special feature to engage no instructor for this meeting who has recently given his subject in the south, or who expected to do so before the time of our meeting.

Hotel Grunewald, the headquarters for this meeting has made special rates for the members of this meeting and their families.

Rooms with private bath—One person, $3.00 to $4.00 per day.

Rooms with private bath—Two persons, $4.00 to $5.00 per day.

Rooms with detached bath—One person, $1.00 to $1.50 per day.

Rooms with detached bath—Two persons, $2.00 to $2.50 per day.

Remember procrastination is the thief of time, now is the opportune time, get busy.

Yours truly.

J. P. WAHL,
Chairman Publicity Committee,
Four States Post-Graduate Dental Meeting.

## MICHIGAN BOARD OF EXAMINERS.

The next meeting of the Michigan State Board of Dental Examiners will be held at the Dental College, University of Michigan, Ann Arbor, Michigan, June 17 to 22, inclusive. Applications and other information may be obtained by addressing

B. S. SUTHERLAND, Sec'y,
Owosso, Mich.

## SOUTH CAROLINA STATE BOARD.

The annual meeting of the Board of Dental Examiners in the State of South Carolina will be held at The Jefferson, Columbia, S. C., beginning promptly at 9 o'clock Monday morning, June 24th, 1918.

All applications must be in the hands of the Secretary by June 14th. Application blanks and full information may be obtained by addressing

R. L. SPENCER, Sec'y,
Bennettsville, S. C.

### ARKANSAS STATE MEETING.

The thirty-first annual meeting of the Arkansas State Dental Association will be held in the Hotel Marion, Little Rock, Ark., June 13-14-15, 1918.

H. J. CRUME, Sec'y,
Hamburg, Ark.

DR. G. C. JERNIGAN, President,
Rector, Arkansas.

### SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the South Dakota State Board of Dental Examiners will be held at Sioux Falls, S. D., beginning promptly at 9 o'clock Monday morning, July 1st, 1918.

All applications must be in the hands of the Secretary by June 24th. Fee for examination, $25. No reciprocity or interchange. Full information and application blanks may be received by addressing,

L. S. SPENCER, Sec'y,
Watertown, So. Dak.

### NOTICE.

The Eighteenth annual meeting of the American Society of Orthodontists will be held August 1, 2 and 3, at the Edgewater Beach Hotel, Chicago, Ill.

This will be an excellent meeting.

It is advisable to make your reservations early.

F. M. CASTO, M. D., D. D. S.,
Secretary-Treasurer,
458 Rose Bldg., Cleveland, Ohio.


# Rhotanium

THE ONLY RELIABLE

SUBSTITUTE FOR PLATINUM

This alloy has replaced platinum in chemical laboratories throughout the United States and abroad.

Now available to the dental profession in Wire, Plate, Sheet Foil and Special Forms.

Price list and information on request.

THE RHOTANIUM COMPANY

CUYAHOGA BUILDING CLEVELAND, OHIO

Name and symbol registered as trade marks in U. S. patent office and alloy patents pending.

# DOCTOR

Are You Satisfied with the Returns from Your Platinum and Gold Scrap?

A shipment to us means Satisfaction to you. We give you the most accurate and highest returns for the Platinum and Gold Scraps, Grindings, Sweeps, Etc., from your Laboratory. We will send cash or exchange your scrap materials for our products, giving you Prompt and Satisfactory service.

# D. HOKE

Refiners of Precious Metals. OTSEGO, MICHIGAN

# KOLYNOS

## OUR SAMPLING CAMPAIGN.

Increased sales and large orders from various governments coupled with "Heatless Mondays" and consequently reduced production, have prevented us from delivering the many requests for samples received from the dental profession during the past thirty days.

On this account we beg your indulgence. We soon expect to be in a position to supply all demands again. If your stock of Kolynos Dental Cream for use at the chair and samples for your patients is running low, please advise us early.

Professional packages are sent only upon written request.

## THE KOLYNOS COMPANY

**NEW HAVEN, CONN.**